ZOE

A BIOLOGICAL JOURNAL.

PUBLISHED QUARTERLY.

VOL. III. APRIL, 1892. No. 1.

CONTENTS:

	PAGE
Forms of Trees as Determined by Climatic Influences: GUSTAV EISEN	1
Catalogue of Land and Fresh-Water Mollusca of Lower California: J. G. COOPER	12
Mariposa County as a Botanical District—II: J. W. CONGDON	25
Notes on Liliaceæ—II: CARL PURDY	43
Note on *Helix yatesii* Cooper: HENRY HEMPHILL	45
Notes on the Cicindelidæ observed in San Diego County: F. E. BLAISDELL	47
Additions to the Catalogue of San Francisco Plants: KATHARINE BRANDEGEE	49
Note on a Californian Loligo: HENRY HEMPHILL	51
A New Astragalus: SERENO WATSON	52
The Loco Weeds: ALICE EASTWOOD	53
Sereno Watson	59
Recent Literature	59

Human Progress, Past and Future. Auk, January, 1892. Preliminary Study of the Grackles of the Subgenus Quiscalus. North American Species of the Genus Colaptes. Geographic Distribution of Life in North America. Wood Notes Wild. American Naturalist, October and November, 1891. Ibis, January, 1892. Beitrage zur Kenntniss Kalifornischer Colembola. Revisio generum plantarum. Monograph of the Grasses of the United States and British America. Fossil Botany. Outlines of Lessons in Botany. Identity of *Asclepias stenophylla* and *Acerates auriculata*.

Proceedings of Societies:

California Academy of Sciences	79
California Botanical Club	81
California Zoological Club	82

SAN FRANCISCO:
ZOE PUBLISHING COMPANY,
P. O. BOX 2114.

Entered at the Post Office at San Francisco as Second-Class matter.

Yearly Subscription, $2.00
Single Copy, 75 cts.

ZOE

A BIOLOGICAL JOURNAL.

Published Quarterly by the

ZOE PUBLISHING COMPANY, San Francisco, Cal.

Subscriptions, $2.00 Per Year; Single Numbers, 75 Cents.

Foreign Countries in the Postal Union, 9 Shillings.

This price is invariable, no discount being made to dealers or agents.

☞Please remit by Postal Note or Money Order. Checks on local Banks not received.☜

EDITORS:

T. S. BRANDEGEE, WALTER E. BRYANT, DOUGLAS H. CAMPBELL,
ALICE EASTWOOD. CHARLES A. KEELER. FRANK H. VASLIT.

Volume I, pps. vi, 389, plate i-xii, and vol. ii, pp. vi, 411, 6 plates, price $2.00 each, may be obtained from the publishers.

ZOE

A BIOLOGICAL JOURNAL.

VOL. III. APRIL, 1892. No. 1.

FORMS OF TREES AS DETERMINED BY CLIMATIC INFLUENCES.

BY GUSTAV EISEN.

A traveler from the Arctics or from the high wooded mountains, in any district of the world, cannot but be impressed by the different forms which trees and shrubs assume in the respective regions. Nowhere is this difference in form more striking than between the trees inhabiting the pine region of Sierra Nevada and those which grow on the lower plains in the interior valleys.

We have so constantly been accustomed to take things as they are, without inquiring into the causes why they are so, that it seems to us quite natural that the forms of trees of the high mountains should be different from those of the lowlands and valleys. Still this difference is so great and so very apparent that the causes which operate in making up these different forms must be very great and very important ones.

In the high Sierras, for instance, in that region below the snow line, where the pines and spruces dominate, we find that almost every shrub and every tree resembles the other in a general way. The trees are tall and erect, with a central undivided trunk from which the branches slope down towards the ground. The shrubs, again, are low and depressed, spreading out horizontally, forming dishlike masses, hugging the ground instead of seeking the sky. A few thousand feet further down in the region where the evergreen pines and spruces have ceased, the trees as well as the shrubs begin to assume a different aspect. The trees in this region are not so erect, their branches are less sloping, their crowns extend further, the trunks are often branching; there is, in fact, a decided difference in their general form. The shrubs, again, are more erect and bushy, forming often dense masses, which show little or no tendency to flatten out.

If we again follow the vegetation further down to the plains, the change in form is yet more pronounced. The trees are here as a rule branched close to the ground, their crowns are wider and spreading, the branches drooping and often sweeping the ground. The general form, which in the higher Sierras was that of an elongated pyramid, has here changed and become globular. We may call these respectively, the spruce form, and the oak form. In the higher mountains we rarely meet with the oak form, at least not in evergreen trees, and on the plains the spruce form is equally rare. There are some exceptions to this rule, but they are few and in no way interfere with the theory which I will here set forth and endeavor to prove. Before we dwell upon the causes which have been and yet are operating in creating and maintaining these characteristic forms of trees, it is necessary to first consider those causes which combine in affecting a change in the form of trees generally.

Nearly every visitor to the wind-beaten and open seashore has noticed the characteristic forms of trees and shrubs growing there. The shrubs spread close to the ground, the trees lean towards the interior, their crowns spread out horizontally and their branches are thorny and knotty and continually bent. Such a sight is common everywhere in exposed places. In sheltered localities inland these same varieties grow upright, their crowns become less horizontal, the branches less twisted, and the same shrubs, which on the sea shore hug the soil, grow here straight and send out slender branches. Even to the least observant the force that operates here and causes the trees and shrubs to so change their shapes is the wind. When we see such trees and shrubs painted on a canvas, we know at once that the landscape is a wind-beaten one, and that the vegetation is struggling against a force which is trying to destroy its foothold.

But while the wind is especially active on the seashore in changing the natural or perhaps the original form of the trees and shrubs, it is similarly effective to a lesser degree in any locality at all exposed to winds. The interior plains, the cliffs on the sides of the desert, the high mountain peaks, the elevated plateaus, the table mountains, the slopes of the more sheltered sides of islands, in fact everywhere may the power of the wind be perceived.

The effects of the wind may be temporary or permanent; temporary, if the plant regains its original form and outward appearance when removed from the windy region to a sheltered one. This is by

far the most common effect and especially refers to shrubs. Many instances may be cited, but I will only mention one. *Baccharis pilularis*, which grows everywhere on the coast around San Francisco, clings typically to the soil and sandhills where exposed to the wind, while on the north side of Tamalpais, where the shelter is perfect and even in the oak scrub of Golden Gate Park, it assumes an erect form. So different is the outward appearance between these two forms, that the former has been described as a distinct species, *B. consanguinea.*

Similarly on nearly all our high mountain tops we meet with scrub-pines growing in the crevices and clinging to the rocks like real coverlets of verdure. But the same species may be found further down in the elevated valleys growing erect with sloping branches and undivided trunks. Such instances are common. I may, however, here especially recall the dwarf and scrubby *Pinus monticola* growing in the cañons on the slope of Mount Dana, while further down splendid specimens are crowding the sheltered meadows.

As an instance, again, where the effects of the wind have been partly permanent we may point to the Monterey pine *(Pinus insignis)* and to the Monterey cypress *(Cupressus macrocarpa)*. Mature specimens of these varieties assume always horizontal crowns, even when growing inland, and only during their earlier growth do they show a tendency to grow erect like most species of pines or coniferous trees generally. We may presume that if the evolution of a species is accompanied by this continued wind force, the latter will to a great degree mould the outward form of the species. If again the evolution of a species takes place under various conditions of wind and calm, the form of the species will be variable according to exposure.

The effect of the wind while apparent everywhere and while found in every climate and in every country is, however, not the most powerful agent in shaping the forms of trees and shrubs. The snow which part of the year covers vast territories, often to a depth of thirty or more feet, has a great influence upon the forms of all plants which are exposed to it for a longer or shorter time.

As the effects of the snow depend chiefly upon the resistance to pressure, it will be seen that evergreen and deciduous trees must be unequally affected. The foliage of the evergreens offers much more resistance to the snow than do the bare limbs of trees and shrubs

which during the winter season are void of leaves. In some horticultural districts, where snow but seldom falls, and where accordingly such trees as olives, oranges and lemons are cultivated successfully, an occasional fall of snow may do and has in many instances done considerable harm. We know that when the snow lodges on the evergreen and upright limbs of orange trees, these limbs become so heavy that they break down, more or less ruining the trees. On such occasions the growers hurry through their orchards shaking off the snow before it begins to melt and become heavy, thus freeing the limbs of the trees from the burden that would injure them. The cause of the mischief is thus not alone to be found in the snow, but also in the upright shape of the limbs and trunks of the trees. Those limbs which point upwards do not yield readily under the pressure of the snow, and trunks which are repeatedly forked, will, if the pressure is heavy enough, split lengthwise. In case the trees in question had possessed downward sloping limbs and an upright, undivided or standard trunk, the effect of the snow pressure would have been less dangerous; the limbs would have yielded to their snow burden, which, when melting, would have slipped off, leaving the limbs free, and the undivided trunks would not have split, and the trees would have escaped without injury. If such snowfalls were frequent and regular, only such varieties could be cultivated as were possessed of downward sloping limbs and upright trunks. All trees shaped otherwise would gradually be ruined and their cultivation become impossible. These last remarks refer only, or at least principally, to evergreen trees. If the orange trees, which we gave as an example, instead of being evergreens were deciduous, that is, presenting only bare limbs in the winter, like peaches, apricots and pears, the pressure of the snow would not have injured them, at least not by breaking their limbs and splitting their trunks, and their cultivation would not necessarily have been abandoned. If we consider a forest, instead of a horticultural district, we will find that the conditions are there very much the same. The yearly snowfall, if only heavy enough, tends to break down and destroy all wild evergreen trees, which do not possess a form suitable to resist the heavy snow mantle. Trees which would thus suffer would be all evergreen trees with spreading crowns, such as live oaks, laurels, madroña, certain pines, such as Monterey pine, digger pine *(Pinus Sabiniana)*, Italian pine *(Pinus*

Pinaster), Lebanon cedar, and the hundreds, if not thousands, of other evergreen trees which inhabit regions below the regular snow line.

Nature thus eliminates from snow-visited forests all evergreen trees which are not suited to resist the pressure of the snow. On the contrary, the snowfall makes it possible for all those trees to live and survive which, through their outward form, are able to easily shed the accumulated snow. As regards deciduous trees, no such upright trunks and sloping branches are necessary, as the bare limbs do not accumulate the snow, nor suffer under pressure. If the above is true, the forests of snow-visited districts will be found to consist of only such varieties of trees as possess the requisite form, that is, evergreen trees with upright, undivided trunks and downward sloping branches, as well as of deciduous trees of various not especially characteristic forms. Upon examination this will also be found to be the case.

A visit to the high pine forests of Sierra Nevada shows us just such forests. Nowhere is the snowfall heavier and nowhere is the characteristic form of the evergreen trees more pronounced. This is also the case in all other show-visited regions where forests are at all able to exist. Where the snowfall is the heaviest and lasts the longest, all evergreen trees, at least during a certain period of their life, possess the required pyramidal form. Evergreen trees of any other form would in their struggle for existence have little or no chance to compete with better equipped neighbors. It follows, also, that the less the snowfall the less characteristic will prove the pyramidal form in all evergreen species, while lower down the mountains on the warmer slopes the pyramidal form may be expected to be entirely absent.

To refer to our nearest high mountains, the Sierra Nevada, we find thus on the snow-belt such trees as *Abies Douglasii*, *Picea amabilis*, *Pinus Lambertiana*, *Libocedrus decurrens*, *Sequoia gigantea*, etc. All these show in a characteristic way the pyramidal form, the snow-shedding branches and the undivided trunk. We find in this region no large live oaks, nor any large evergreen trees of globular or goblet shape. But in the region immediately below the heavy snow belt, the characteristic pyramidal shape is entirely absent. The forms of the evergreen trees are here evidently regulated by other agencies. In this region we meet with several evergreen

oaks with large crowns, spreading branches and repeatedly divided trunks. The pines also, like *P. Sabiniana*, are characterised by their forked trunks, their upright limbs, and by their general resemblance to deciduous trees. As regards shrubs of all kinds, they are hardly less influenced by snowfall. In the snow-visited forests at least, the evergreen shrubs show a low depressed form, sometimes spreading out like dishes on the ground. Other species, again, like the manzanitas, possess repeatedly zig-zag bent limbs especially adapted to resist the pressure of snow and wind. Such zig-zag form is also possessed by the branches of trees, greatly assisting them to resist outside pressure of any kind. Thus while the lower or central branches of most of the pines in the snow region slope downwards, the upper limbs, which are naturally less exposed to snow pressure, assume a horizontal position, but are compensated by being repeatedly bent and furnished with heavy knees. Such limbs are generally seen in the various species of pines, such as *Lambertiana*, *contorta*, *Jeffreyi*, also in *Sequoia gigantea*, etc., while they are almost absent in the spruces and firs, the sloping elastic limbs of which continue to the tops.

SUNLIGHT AND HEAT.

Another important agency in shaping the forms of trees is the direct sunlight and heat. As the force of the direct rays of the sun is different in different places, it follows that their effect upon trees and shrubs must vary with the locality, as well as with the physiological structure and nature of the plants. Various other agencies, such as the moisture in the air, the force of the wind, the rainfall, dews and fogs, combine with the sunlight and heat, either in decreasing or increasing the effects. It is especially in warm and dry regions where the heat and light are all powerful in modifying and directing the development of the form of a tree or shrub. An excess of heat and light is nearly always hurtful and may even be so injurious as to kill the trees, or make them unfit for the region. It is especially the horticulturist that notes these effects of heat and light. In tender plants the effects are more pronounced and principally of two kinds. The direct rays of the sun injure the stem or trunk on the southwest side, or on the side on which the greatest force of the sun rays are concentrated during or shortly after midday. The tender bark and cambium are scorched, dry up and pre-

vent the sap from circulating. In course of time injurious insects, such as borers of various kinds, find their way through crevices, and parasites gradually destroy the trees. Trees which are thus especially tender are, among cultivated trees, apples and pears, and among wild trees, weeping willows, poplars, young oaks, maples, etc. A tree when once injured seldom recovers if left to itself, but dies or at least becomes sickly. In order to counteract this fatal force of excessive light and heat combined, the horticulturist encourages lower limbs and foliage, prunes his trees low, or otherwise shades the exposed parts. Nature works very much in the same way. Young trees growing in heated regions are covered with lower limbs thickly set with foliage, or develop large weeping tops or crowns with drooping branches, which shelter the tender stems as effectually as if they were covered with an umbrella. That such a shade is absolutely necessary can be clearly demonstrated. There is, for instance, no more tender tree than our common weeping willow, a native of the hot region of Asia Minor. This tree flourishes even in our warmest regions under proper conditions of moisture, as long as its natural form is not interfered with. But let anyone prune back its limbs and cause the direct rays of the hot sun to strike its trunk, and the tree will soon become diseased and die. The dying of weeping willows is common all over the warmer parts of this state, and is everywhere to be principally ascribed to the cutting away of limbs and to the entrance of heat and direct light.

The excessive heat and light has also a bad effect upon the ground in places where rain or other moisture is scarce. The sun dries out the soil and makes it too dry for the trees and plants. To counteract this heat, nature causes lower limbs to spread out as close to the ground as possible, or furnishes the tree with large dense and rounded crowns which cover the soil with shade and prevent the moisture in the immediate vicinity of the trunk and roots from drying out.

Nature furnishes also other remedies, such as peculiar position of the leaves, tough and hardy bark, gray and light colors of leaves and stems, hairs or cells especially constructed to withstand evaporation or heat.

While the snow especially affects evergreens, the heat and light affect evergreens and deciduous trees almost alike.

In the tropics the intense heat develops another tree form, the umbrella form. In this region the heat is always accompanied by moisture, and is thus never excessive or dangerous for trees which naturally seek the light. The moisture and heat combined produce a most vigorous and dense vegetation, the very opposite to what is found in the arid zones. The effort of the tree is therefore concentrated in its endeavor to reach the light and to push out from the dense shade nearer the ground. The most vigorous growing trees in this region send up straight and undivided trunks to a level with the top of the dense undergrowth, branch at this level and form immense umbrella-like crowns above less vigorous trees. This umbrella-form gives to the tropical landscape a distinct and characteristic appearance. A tendency to assume such an umbrella-form can also be recognized among those trees of the temperate zone, which grow in moist places, such as river bottoms, cañons and other sheltered localities—trees in fact, which delight in moisture. But nowhere is the form so pronounced as in the tropics, where it is common with all large species of the denser forests. The uplands of the tropics, where the rainfall is less and where heat and drying winds are more powerful, and where accordingly the vegetation is less dense, the umbrella form is rare, or where it exists is caused by other agencies.

The origin of the tropical umbrella form is therefore not exactly identical with that of the umbrella form assumed by most pines in such districts as the Mediterranean or the gulf region of the United States, and to a certain extent also by a few more northern pines. This umbrella form is caused by the falling off of the lower branches, which never possess the strength of the upper limbs. The umbrella form, however, greatly favors their struggle against wind and heat.

In these drier places in the tropical districts the umbrella form gives place to the globular form, the conditions there being quite similar to what they are in the drier regions further north. Observe, for instance, the form of the ceiba *(Bombax Ceiba)*, which inhabits dryer localities in the Central American tropics. This tree is almost globular in shape, in order that its branches may give necessary shelter to the trunk and to keep away the reflected heat. An effort to change the form of this tree by pruning results fatally, as the branches become sun scalded and a prey to borers which

eventually destroy the tree. In crossing Central America I was especially impressed by these different tree forms, characteristic of different regions. Along the lowlands of the Pacific Coast up to 2,000 to 3,000 feet, the characteristic form of the various strong growing trees was the umbrella form. Above 3,000, and from that altitude towards the interior in the dry and warm district the globular form predominates. As we ascend the interior highlands in the vicinity of Coban the climate suddenly changes and becomes very moist. With this change comes also a change in the form of the trees which here assume the regular umbrella form. The same climate continues uninterrupted to the Atlantic Coast, and the district is characterized throughout by the predominating umbrella form.

All trees require more protection when young, and this explains why young trees are shaped differently from older trees. Thus the form of a young specimen of the common blue gum *(Eucalyptus)* is well known. While young the tree is pyramidal and the sloping branches are covered by horizontally extended leaves. No form can be more adapted to withstand heavy winds. As the tree grows older, the stem stronger, and the roots penetrate deeper, this original form is not required any more, and the tree assumes a **semi umbrella-like crown.**

If we consider the principal forms of trees in their connection with influences of wind, snow, rain, sunshine and heat, we find that the various forms may be grouped principally under the following heads:

A. The upright form, with a central undivided trunk and with downward sloping branches. This form is possessed by most conifers inhabiting snow-visited regions. The downward slope of the branches facilitates the shedding of the snow, while the undivided trunk offers less resistance to heavy loads of snow. Forked or **branched trunks would split or break.**

This form may be either necessary to the species, as when the latter is confined to snow-visited districts (example *Picea amabilis)*, or it may be inherited and continue as a characteristic of the species which grows in a warmer climate, but which evidently had been evolved from a species which once inhabited colder regions. Example: the redwood *(Sequoia sempervirens)*, Lawson cypress *(Cupressus Lawsoniana)*, and many other evergreen trees inhabiting

the moist, snowless climate of the Pacific Coast north of San Francisco.

B. The upright form with erect or horizontal branches. The upright trunk in this form must be considered as inherited from ancestors where it was a necessity. Later on the sloping branches gradually assumed a horizontal position. Example: most species of cypress, yew, juniper, etc., of a more southern origin. It is interesting to note the form of *Cedrus Deodara* or Himalaya cedar. This tree, growing in regions of Himalaya where heavy snowfalls are not unfrequent, possesses while young characteristically downward sloping branches. *Cedrus Libani*, Lebanon cedar, which is only a form of *C. Deodara*, possesses no such sloping branches, but horizontal branches, evidently developed in a climate where the absence of heavy snow has made the downward slope of the branches unnecessary. Most species of juniper possess erect branches, as would be expected in a genus which finds its most congenial home and greatest development in the warmer regions of the Mediterranean where snow is almost unknown.

One species (*Juniperus communis*), however, which is common in Northern Europe, is distinguished by a very different form from the southern species, being dwarfed, prostrate, and repeatedly branched. But that this form of the European juniper is not the natural one, can be seen by the fact that whenever this species is transferred to snowless localities it at once assumes the upright form, growing as straight and slender as a southern cypress. Similarly we find this upright form possessed by all specimens of this juniper which grow in close proximity to smelting works, where the heat is strong enough to melt the snow. The different appearance of this juniper in such localities is really most startling.

Pines which inhabit snow-visited regions are as a rule very upright, with downward sloping branches, while the southern pines, both in Europe and North America, as well as in Central America and Mexico, have branches which either spread horizontally or which stand erect. Compare, for instance, *P. Lambertiana* and *P. Cembra*, which inhabit snow-visited regions, with such species as Aleppo pine (*P. Halapensis*), *P. maritima*, *P. insignis*, and *P. Sabiniana*. Judging by the forms of most species of pines it would seem as if this genus is more of a southern origin, than for instance the various genera of firs and spruces, which through their very characteristic

undivided stems and sloping branches indicate their origin in the snowy regions in the north.

C. The globular form. This form is possessed by trees in warm and dry regions or localities. The object of the form is to protect the tree from sun and heat, and to preserve the moisture in the soil around the root. Example: the live-oak, the wild California walnut, the Texas umbrella, and the tropical ceiba, or Bombax tree. The mesquite of the Mojave desert belongs to this form.

D. The umbrella form. This form is principally found in moist tropical climates. The object of the form is to give to the tree as much sun and heat as possible, which can again only be had at a certain altitude above the tops of the dwarfer vegetation. Example: various papilionaceous trees, as well as most varieties of trees in the tropical lowlands of both continents.

In connection with this, I will call attention to the form of the bases of the trunks and of the surface roots in trees growing in moist places, especially in the tropics. The trunks branch out above the soil and form peculiar horizontally compressed roots, sometimes five to six feet high, but only a few inches thick. Such surface roots are found in most tropical trees, as well as in many swamp trees; for instance, the swamp cedar of the Mississippi delta. The object is to steady the tree when floods or excessive rains soften the ground; round roots would then offer much less resistance.

I have here merely tried to outline the principal forms of trees and their trunks and branches, and have endeavored to state the causes which have been at work in moulding them.

There are, however, many other agencies which assist in forming the shape of trees. Such are the elasticity of the wood, which would make the pyramidal shape of the tree less necessary; hairiness of the leaves, which tends to counteract sun and dryness; a tough and thick bark, which would also render sun and heat less injurious—all these must be taken in consideration when we study the forms of trees.

CATALOGUE OF THE LAND AND FRESH-WATER MOLLUSCA OF LOWER CALIFORNIA.

BY J. G. COOPER.

In an article published in the Proceedings of the California Academy of Sciences, second series, vol. iii, April, 1891, I stated that only three species of land shells had yet been found to inhabit the region on both sides of the boundary-line near lat. 32° 30′, while twenty-one were peculiar to the southern half of the peninsula. I overlooked an incomplete list by Mr. C. R. Orcutt in the "West American Scientist," ii, 61, July, 1886, adding five northern species, which he had traced southward to (or near) lat. 31°. They were identified by Mr. Binney. He and Mr. H. Hemphill, also found three new species on both sides of the line, and added much to the known distribution of others. (See Binney's 3d Supplement to Terr. Mollusks, 1890, pp. 205, 219, 221; also the 4th Suppl., 1892, and the "Nautilus" for 1890–91.)

To furnish a basis for future reference, and to point out some facts needing investigation, I have compiled this catalogue of all the species known from the peninsula and adjacent islands. To simplify the list I omit the sub-generic names, many of which are badly founded, thus using the nomenclature nearly as given by Binney in the "Land and Fresh Water Shells of North America," (Washington, 1869).

That is the latest work giving a full account of the shells of the peninsula, and in the twenty-one years since its issue nineteen land species have been added, eleven or twelve fresh-water, and one marine pulmonate species, doubling the number then known.

Probably no other country has had so many errors made in the localities given for its land-shells, and I therefore give every reference accessible, chiefly from Carpenter's "Mollusca of Western North America," 1856 and 1864, explaining the causes of errors as far as possible.

The geographical range of each species, as far as known, is given in the proper places.

The great variability in external characters observed in all west-coast land and fresh-water mollusca is strongly marked in those of the peninsula, and will doubtless lead to reduction in number of species. I have indicated some of these where most striking, but

at the same time I am in favor of retaining many others as subspecies or varieties. Those who have seen Mr. Hemphill's recent Catalogue of N. Amer. Shells, etc., will understand how the multiplication of names may be carried to excess, and I therefore mention only those that are best defined. Many more local forms must be collected before they can be properly defined.

It will be observed on measuring the peninsula as mapped by the U. S. Coast Survey, that on account of its position, oblique to the meridians, it is much longer than would appear by a calculation from latitudes, the difference being 120 statute miles, and total length 820 miles. The distances apart will thus be greater than the degrees of latitude indicate, by nearly fifteen miles in every hundred, in the long axis of the peninsula.

I refer to this because I have found it necessary to give the latitudes of localities on account of the frequent repetition of names, in places at various distances apart. By referring to Mr. Brandegee's map, we find that towns, old missions, ranches and waterholes (camping places), may each have the same name though far apart, and that bays, points and islands add to the confusion. Thus they can only be distinguished by giving the latitude as near as possible, those on the coast only being exact. Such errors of localities are mentioned as to fourteen out of forty-eight species mentioned in this article.

There are several explanations of the confusion of localities on the peninsula, and most of it comes from the too frequent use of the names of the saints. This would not be so bad, if the surnames distinguishing them had been retained, as first given by missionaries, but being cumbersome they have been gradually dropped in most cases, though retained where very necessary, as with San José del Cabo. In other cases the same names are repeated in the three separate states of the peninsula, as they are in many of the United States, but sometimes three in one state as with the San Juans. Many Indian and other names are also repeated, probably from the ignorance of those naming them. The name of nearly every saint in the calendar is repeated two or three times in those 820 miles.

Carpenter states that Xantus sent shells to Washington from Socorro Island, and other localities, mixed with those of Cape St. Lucas.

On account of the marked differences in the groups of species

inhabiting the mountains, the salt water, and the desert region near the Colorado River, I have divided the list into three parts. The last has not before been included in lists of species belonging to Lower California. Though the desert species do not extend into the peninsula itself below lat. 31° 30′, they have been known for thirty-six years to be found along the Colorado River and its back-water overflow, called "New River," which discharges fifteen miles south of the boundary. Until recently most of them were supposed to be extinct species.

In this catalogue I have used the alphabetical order for convenience of reference, and quoted authorities chronologically in references to localities, etc. Those given in quotation marks have not been confirmed or corrected. Most authors before 1850 confused Upper with Lower California.

Collectors' names are given in italics to indicate that they were at the places mentioned, while those quoting them are usually marked by names in brackets.

The species thus far collected on the peninsula and islands near by have been all of considerable size, and no attempt seems to have been made to find the very small species, except in the part north of lat. 31°, from whence five are known (Nos. 26, 30, 31, 32, 33). Though the more arid regions may not produce them, the moist seashores, damp cañons, and mountain summits, will no doubt still furnish novelties to a careful searcher, many of good size, as shown by Gabb's success in the mountains near the east coast.

A. Species of the Mountain Regions.

1. Binneya notabilis J. G. Cooper, 1863. Santa Barbara Island, Cal., lat. 33° 30′ (types). West coast of Mexico (" *Xanthonyx* " Crosse & Fischer). Guadalupe Island, over 100 miles southwest of San Quintin Bay, near lat. 29°, *Palmer*, *Bryant*, San Quintin, Lower Cal., lat. 30° 24′, *Orcutt*.

2. Bulimulus artemisia W. G. Binney, 1861. " Promontory of Cape St. Lucas, lat. 22° 52′, one specimen, *Xantus*.

B. californicus Reeve, 1848, is not confirmed as from the peninsula, but is believed by late authors to be from the main land.

3. B. excelsus Gould, 1853. "California," Maj. Rich, La Paz, lat. 24° 10′, later, in Carpenter's work; also found there by *L. Belding*.

4. B. GABBI Crosse & Fischer, 1872. Locality unknown, and only one specimen known, which has characters between those of *B. pallidior* and *B. proteus*. These two allied forms are not reported from any one locality except Cape St. Lucas, therefore a hybrid theory cannot now be proved. It may prove a variety, if *B. vegetus* Gould, which is also intermediate, is not a good species.

5. B. INSCENDENS W. G. B., 1891. "Cape St. Lucas and 450 miles up west coast" (Cedros Is. lat. 28° 02′ not confirmed), Xantus. .

Var. BRYANTI J. G. C., 1891. San José del Cabo, lat. 23° 24′, to La Paz, lat. 24° 12′. The east coast form, more developed.

6. B. PALLIDIOR Sowerby, 1833. "Chili," *Cuming* (Pfeiffer). "West coast of peninsula for 350 miles north (to Ballenas Bay, lat. 26° 45′, not confirmed), *Xantus*. La Paz, Maj. Rich. San Juan, east coast, lat. 26° 20′, Lt. Greene, type of *B. vegetus* Gould, 1853. Near San José del Cabo to La Paz, *Bryant*. "San Diego" (Carpenter), not confirmed. Perhaps imported from Chili into gardens with roots, and has since died out northward. No other collectors seem to have found any *Bulimuli* on west coast north of lat. 25°. Mr. Binney mentions several species carried about with roots of banana, etc., from one country to another, and this may account for the introduction of this and *B. proteus* on to the peninsula.

7. B. PILULA W. G. B., 1861. Todos Santos, lat. 23° 25′, to Margarita Island, lat. 24° 20′, *Xantus*. San José del Cabo, *Bryant*.

8. B. PROTEUS Broderip, 1832. "Peru and Chili," *Cuming?*, (Pfeiffer). "Cape St. Lucas," *Xantus*. Northern Peru, *Orton*. (Binney). Perhaps another importation as with *B. pallidior*. The question of their importation as food is yet undecided.

9. B. SPIRIFER Gabb., 1867. Near La Paz, lat. 24° 10′, to San Borgia near lat. 28° 40′, among rocks, in the mountains near east coast, *Gabb*. San Borgia is a little west of the middle line in crossing the peninsula, and thus the most northern and western locality for *Bulimuli* as yet well authenticated. It is about 450 miles from the cape, and may possibly have furnished Xantus with northern specimens, which could be mistaken for *B. pallidior*. With such an extensive range near the east coast it is strange that nobody had found it before. Gabb's figure is more like *B. pallidior* than Binney's.

10. B. SUFFLATUS Gould, 1853. La Paz, lat. 24° 10′, *Maj. Rich, Gabb.* San José del Cabo, *Bryant.* The large, east coast form of *B. pilula.*(?) Not found by Xantus, nor on west coast. Bryant also found a few pale brown ones, besides the usual white; both colors in living shells.

11. B. XANTUSI W. G. B., 1861. "Promontory of Cape St. Lucas," four specimens, *Xantus.* The three species reported from the Cape, but not since detected, and two others which Xantus stated to extend so far up the west coast, but not confirmed, were perhaps considered by him as varieties of one or more of the other species. The possibility that he obtained some from Socorro Island, or from the Mexican coast, where he also collected, is to be considered.

12. CYLINDRELLA IRREGULARE Gabb, 1867. Central range of mountains near east coast, around Mulejé, lat. 26° 50′, *Gabb.*

13. C. TAYLORI Pfeiffer, 1861. *(C. newcombiana) Gabb*, 1867. Same locality as the last, *Gabb.* Original locality of Pfeiffer's type unknown.

14. HELIX AREOLATA "Sowerby MS." (Pfeiffer, 1845). California *Hinds*, "near Columbia River" (Pfeiffer). This confusion can only be explained by mixing of labels, as Pfeiffer seems to have received these shells from the British Museum for description, with the MS. names. "Margarita Bay, lat. 24° 20′. The only land shell received from the bay," (Pease). Cedros Island, lat. 24° 02′, *Veatch*, a very large form described as *H. veatchii*, Newcomb. These, with *H. levis* and *pandoræ*, form a closely allied group.

In 1867 Mr. W. M. Gabb made a geological exploration of the peninsula for a land company, under J. Ross Browne, traveling the whole length and crossing it ten times. In his report to Mr. Browne, dated San Francisco, 1869 (published in J. R. Browne's Report on Mining Regions), he mentions finding immense numbers of this species, sometimes whitening the ground with bleached shells, and extending from Salada, lat. 24° 15′, to San Tomas, lat. 31° 35′, on west coast. He mentions none of the allied forms, and thus appears to consider them varieties. (See notes on them). Dr. Veatch in same report states that the var. *veatchii* was the only land shell he found on Cedros Island, and on the peninsula east of it.

Unfortunately Gabb nowhere records any notes on other species, except eight, as quoted in this paper.

15. H. DURANTI Newcomb, 1864 (var. *cælata* Mazyck). Santa Barbara Island, J. G. C. (types). Northern race from Healdsburg, 38° 38′, Calif., to Sta. Barbara, *Hemphill.* The var. thence south to San Tomas, lat. 31° 35′, *Yates, Hemphill.*

16. H. KELLETTII, Forbes, 1850. "California," (Santa Barbara),? *Kellett.* "San Juan del Fuaco," (Forbes). This San Juan having been proved to be neither the Straits of De Fuca, nor San Juan Capistrano, southern California, lat. 33° 30′ (northern limit of this shell), is usually considered as the port on the east coast, lat. 26° 20′, visited by Lt. Greene, who did not find this shell there (neither did Gabb). Forbes states that this and *H. pandoræ* were obtained on the *west* coast, probably between "San Diego and Magdalena Bay," lat. 24° 32′. (Carpenter, Rept. on Moll. of West Amer., 1856, p. 239.) Yet it has been generally confounded with the Straits of Juan de Fuca (an explorer, who made no claim to be a saint). Kellett & Wood also surveyed in those straits, and there are both a bay and an island named San Juan there. But none is given on late maps along the west coast of the peninsula, though two "San Juans" are put down as on the gulf shore, one distinguished as a bay, about lat. 26° 20′, the other at a point of land in lat. 28° 25′, and a third one, a camp station, near lat. 28°, twenty miles inland, all visited by W. M. Gabb.

There is also a San Juanico on west coast, lat. 26° 12′, where Gabb collected marine shells (only ?) as given in a catalogue printed in the Proc. Cal. Acad, Sci., series i, vol. v, 1875. Even this was confounded by Stearns with San Juan Bay, and it is left uncertain at which place the marine shells were collected, though Gabb in the report before mentioned. states that he collected some at San Juanico, one of the places at which he crossed the peninsula.

The well-known Spanish custom of distinguishing the patron saint of a locality by a surname taken from some local incident, leads to the inference that the one above named was so entitled from either the word fuco (seaweed) or fuego (fire), in either case mis-spelled by Forbes. Then the fact that the two land shells are only known to exist together between lats. 29° 30′ and 30°, the most arid and rocky region on the west coast, suggests that a landing was made

in that region near some ranch which has since been abandoned (like many others), or was never mapped down. The type figured by Forbes was smaller and higher-colored than any variety of the species now known from its more northern range, of which ten or more have been named by Hemphill and others. Its lost station may be one of the small islands. The blunders of authors that were made before 1873 as to this locality are amusing, and it was not until then that explorations had proved that the two species named must have come from the peninsula, together with the two allied forms, while positive locations are only now ascertained. "Central America" given by Reeve is about as bad an error as Straits of Juan *de* Fuca. (N. B.—J. R. Browne states that this is a real family name, but the *San* Juan has it *del* meaning "*of the.*")

17. H. LEVIS Pfeiffer, 1845. "California," *Hinds*. El Rosario, lat. 29° 50′, *Orcutt*. "Columbia River" is another blunder of Pfeiffer's (see *H. areolata*). Varieties indicate that this form may intergrade with that and *H. pandoræ*. It seems limited in range between the two forms named.

18. H. NEWBERRYANA W. G. B., 1858. San Pedro, Cal., lat. 33° 40′, *Yates* (fossil only?). San Diego, *Newberry*, lat. 32° 40′. South to Ensenada, lat. 31° 51′, *Orcutt*.

19. H. PANDORÆ Forbes, 1850. "Santa Barbara as per box label" (Carpenter). "San Juan del Fuaco, Kellett and Wood" (Forbes). "Margarita Island, lat. 24° 20′" (Newcomb, Binney). San Quintin, lat. 30° 24′, *Orcutt*, the only positive location yet obtained, but is reported from further north. Forbes' locality is explained under *H. Kellettii*, but it is not identified for either species lately. The next is probably correct, but conflicts with Pease's statement about *H. areolata*. It seems probable that he, as well as Gabb, considered this form, like the small form of *areolata*, merely one of the varieties of that species. *H. damascenus* Gould, 1856, from "Desert east of California, *Dr. Frick*" (Newcomb), but not confirmed from north of the boundary, was probably from near San Tomas, and is considered a variety of *pandoræ*. As to variations in this group compare the figures already published. W. G. Binney gives copies of the original types in Terr. Moll. of the U. S., vol. iv; in Land and Fresh Water Shells he figures quite different varieties of all these species, and Tryon in the Monograph,

Amer. Jour. of Conchology, vol. ii, gives two others, all these intergrading.

20. H. ROWELLII Newcomb, 1865. "Arizona" *Dr. Frick.* This has lately been confirmed by specimens obtained near Phœnix (Pilsbry). A variety from near Mulejé, lat. 26° 52′, was described as a new species, "*H. lohrii*" Gabb.

An intermediate locality has been recently discovered by Dr. S. Bowers in San Gorgonio Pass, near lat. 33° 40′, at the east base of the San Jacinto Mountains, eight miles south of Indio Station, and about the level of the former lake (or sea), among granitic rocks. There is a limestone bed a little higher up near which they may be found living. Like all found, so far, except Gabb's var. *Lohrii*, they were dead shells, but retained the band, which was faded out in Newcomb's type, as described by him. For this reason, doubtless, their identity was not recognized by Gabb at first, and Dr. Yates also added a synonym or variety in describing Dr. Bowers' shell, as "*H. carpenteri* var. *Indioensis*" in Nautilus, vol. iv, p. 63, 1890. It is also reported with some doubt from "Guadelupe Island, Dr. Palmer" (Binney), who got only young shells, while Bryant found only *H. carpenteri*, but in perfect condition.

21. H. (RUFOCINCTA?) FACTA Newcomb, 1864. Santa Barbara Island, lat. 33° 30′, and San Nicolas Island J. G. C. (types), the large forms from Catalina Island, lat. 33° 20′ "Guadelupe Island, lat. 29°" *Palmer*, *Dunn*. Some of these are subangled and umbilicate. Through *H. gabbi* Newc., and some fossil forms, all are closely connected.

22. H. STEARNSIANA Gabb, 1867. El Rosario, lat. 29° 55′, to San Tomas, lat. 31° 35′, *Gabb*, on west slope only. Coronado Island, lat. 32° 25′, *Hemphill*. Near San Diego, *Orcutt*. A connecting link between the typical *H. kelletii* and those northward, considered varieties of that species. Mr. Gabb's most southern locality seems to fix the southward range definitely.

23. H. TRASKII Newcomb, 1861, and var. CARPENTERI Newc., 1861. Los Angeles, lat. 34°, (type) *Trask*, to Point Conception, lat. 34° 25′, *Yates*, and San Diego, lat. 32° 40′, *J. G. C.* The variety from Tulare Valley, lat. 36°, (type), to Coronados Island, *Dunn*, lat. 32° 25′, and Guadelupe Island, *Bryant*, lat. 29°. The "*H. remondii*" Gabb (not Tryon, 1863), scarcely differs

from *H. carpenteri*, and extends from Trinidad, lat. 28° 45′, on west coast, to Mulejé, lat. 26° 52, on east, also "Guaymas, Sonora, Mex.," Gabb. The Mexican form is, however, different, and is Tryon's type, while the peninsula shells are probably all *carpenteri*.

24. H. TUDICULATA Binney, 1843. Not far south of the boundary line, *Orcutt*. North to lat. 37°, in Sierra Nevada. "Petaluma, California," *Stimpson*, (Gould) is an error in identification.

25. H. (VANCOUVERENSIS Lea, 1839), var. SPORTELLA Gould, 1846. Near the boundary line, *Orcutt*. Those found near San Diego seem to me as near the typical Oregon shell of Lea. *H. vellicata* Forbes "Panama," seems externally very similar, and is united with it by Binney. Not being confirmed from Panama, it forms another proof of the errors in localities due to Kellett and Wood. Mr. Hemphill has lately described the smaller form found south to Ensenada as var. *transfuga*.

26. LIMAX HEMPHILLI W. G. B., 1890. San Diego Mountains to San Tomas, lat. 31° 35′, *Hemphill* (and to lat. 31°? *Orcutt*). This is the species mentioned by me in the Proc. Cal. Acad. Sci., 2d ser., I, p. 13, 1887, at bottom, as perhaps *L. agrestis* Linn. In the "4th Supplement to 5th vol. Terr. Moll.," January, 1892, Mr. Binney now states that this species is found from British Columbia to Lower California, having been confounded, in some cases, with *L. campestris*. An extreme southern form has also been named var. *pictus* by Cockerell. *Anadenus cockerilli* Hemphill, another slug allied to the northern *Ariolimax*, discovered on the San Diego Mountains just north of the boundary, may extend southward.

27. LIMNOPHYSA HUMILIS Say, 1822. Ensenada, lat. 31° 51′, *Orcutt*. Also found in nearly all the United States (and Europe?).

28. PHYSA GABBI Tryon, 1863. Found near middle of west coast of peninsula, *Bryant*, thence north throughout southern half of California. By many called a var. of *P. heterostropha* Say, 1817.

29. P. DIAPHANA Tryon, 1865. In brook at San José del Cabo, *Bryant*. Has same range northward.

P. elata Gould, described as from "Lower California, Maj. Rich," was doubtless from Mazatlan only, as given in Carpenter's Catal. The same applies to *P. aurantia* Carpenter.

"*P. heterostropha* Say," 1817, is said by Stearns to be from "Hot Springs, Lower California, *Orcutt.*"

30. PUPA CALAMITOSA Pilsbry, 1889. San Tomas, lat. 31° 35′, *Hemphill.* (To lat. 31°? and San Diego, *Orcutt.* Two species are mentioned by Orcutt without specific names, probably this and *P. hemphilli.*)

31. P. CHORDATA Pfeiffer, 1856. Sinaloa, Mex., near lat. 26°? (type). San Quintin Bay, lat. 30° 24′, "on salt marsh," *Orcutt.* In habits is a link towards *Melampus* and *Pedipes.* From ability to bear salt, it can inhabit the driest zone.

"*P. orcutti* Pilsbry," named by Orcutt, in the West Amer. Scientist, October, 1891. p. 270. is probably a synonym of *P. chordata*, as I find no other notice of such a species.

32. P. HEMPHILLI Sterki, 1890. San Diego to San Tomas, *Hemphill.*

33. P. OVATA Say, 1822. Across the continent in nearly every State. San Diego south to lat. 31°, *Orcutt.*

34. RHODEA CALIFORNICA Pfeiffer, 1846. "Monterey, California," (Pfeiffer), certainly an error. Bogota, New Grenada, *T. Bland.*

Subsp. RAMENTOSA J. G. Cooper, 1891. Mountains north of San José del Cabo, one dead shell in a cave, *Bryant.* It may prove to be now extinct.

35. SUCCINEA OREGONENSIS Lea, 1841. Oregon, (types) and south to lat. 31°, *Orcutt.* Also Vancouver Island, *G. W. Taylor.*

36. VERONICELLA OLIVACEA Stearns, 1871. Nicaragua, west slope, *McNeil* (types). Lower California, *Hemphill.* "Lobitos Creek, California, lat. 36° 52′," *Stearns.* This locality has been recently searched for them in vain by Raymond (1891).

This fresh-water slug leads to the salt-water pulmonate Onchidellas, etc., which I merely catalogue, as nothing new is to be said of them, referring to Binney's work for further information, they being beyond the scope of this article. I add also three non-pulmonates that belong to a genus sometimes inhabiting fresh or brackish water in estuaries.

"*Zonites diegoensis*" Hemphill, 1892, a minute *Helicoid*, from Cuyamaca Mountains, at 4,500 feet altitude, east of San Diego may also be looked for southward.

B. Marine Species. 1. Pulmonate.

Melampus olivaceus Carpenter, 1857. Mazatlan, Mexico, to Monterey Bay, California, lat. 23° to 36° 30′, salt marshes.

Onchidella carpenteri W. G. B., 1860. Cape St. Lucas, *Xantus*. Doubtfully reported from lat. 48° north.

Pedipes liratus W. G. B., 1861. Cape St. Lucas, *Xantus*, to San Diego, *J. G. C.*

P. unisulcatus J. G. Cooper, 1867. San Pedro, California (types). Head of Gulf of California, *Palmer*.

Siphonaria æquilirata Carpenter, 1867. Margarita Island, lat. 24° 20′, to South America (Carpenter).

S. lecanium Philippi, 1846. Cape St. Lucas to Acapulco, Mexico (Carpenter).

2. Estuarine. Non-Pulmonate, operculate.

Neritina californica Reeve, 1845. Gulf of California.

N. cassiculum Sowerby, 1832, is supposed by Carpenter to have been obtained at "San Miguel, lat. 29°, Lower California," by Lieut. Greene, U. S. N., also Mazatlan, Mexico.

37. Neritina picta Sowerby, 1832. Panama, *Cuming*. North to Guaymas, lat. 28°, on gulf coast, and Magdalena Bay, lat. 23° 30′, on west coast of peninsula, in brooks near the sea. This scarcely deserves to rank as a fresh-water shell, as it always occurs near tide-water and must travel through the sea along the coast. The habits of the other two species have not been recorded, but some are known to be entirely marine, others also found in fresh water.

Mr. Binney also includes among "Land and Fresh-water" shells the *Truncatellas*, which are allied to some land genera, but wholly marine, so I omit them here.

C. Colorado Desert Mollusca.

Very little is known of the Land and Fresh-water species east of the peninsula mountains and north of lat. 31°, but the region is known to share in the arid and barren characters of the desert north of the boundary with scarcely any fresh water, a minimum of rain, and consequently a barren soil. Prof. Blake, Mr. Orcutt and

others have, however, traced the same species so common as fossils in the desert, along New River, and they no doubt exist, sub-fossil if not all living, to the mouth of the Colorado River, or to tide-water, near lat. 32°.

38. AMNICOLA LONGINQUA Gould, 1855. *Living* at Lake Point, Utah, *Hemphill. Quaternary*, Nevada to Colorado Desert.

39. ANODONTA (NUTTALIANA) CALIFORNIENSIS Lea, 1852. *Living*, British Columbia to Arizona, Colorado River, *J. L. Leconte*, etc.

40. GNATHODON MENDICUS Gould, 1851. *Living*, Colorado estuary, *Dr. J. L. Leconte*, to Mazatlan, Mexico, in brackish water, *Reigen.*

41. HELISOMA AMMON Gould, 1855. Klamath Lake, Oregon, to Colorado Desert, (and river, *J. G. Cooper*).

42. PHYSA HUMEROSA Gould, 1855. Pyramid Lake, Nevada, to Colorado River, and Texas, *Blake*, *Webb*, etc.

43. PLANORBIS GRACILENTUS Gould, 1855. Colorado Desert, *Dr. T. H. Webb. P. leibmanni* Dunker, 1844.? from Vera Cruz, Mexico, is supposed by Binney to be the same species, and identified from Texas also. No confirmation of the desert locality recently.

44. TRYONIA CLATHRATA Stimpson, 1865. Colorado Desert, fossil only? *W. P. Blake.* Lately reported as living in Utah, (Stearns.)

45. T. EXIGUA Conrad, 1855. *Living*, southern Utah (to Dos Palmas Springs, lat. 33° 30′, Colorado Desert, *Orcutt*).

All the above except 40 and 43, are found in vast nnmbers around the shores of the dry lake constituting the desert, as fossils, Quaternary, or later. These are chiefly of more northern species than most of the peninsula shells, Nos. 40? and 43 only, being now limited to the south of the boundary, and are all aquatic. Only 41, 42, 43 are pulmonate, the others being of orders not represented on the peninsula.

The portion of the desert south of the boundary is a triangular tract about 70 miles along the boundary, and 130 along the 115th meridian (which are nearly at right angles), the third side at foot of the mountains being about 150 miles long, and ending near lat. 31°, thus embracing about 4,550 square miles. A large part of this

is a barren saline plain. The mountains west of it are less barren, and must contain some of the species reported from the region westward, near the ocean. No. 20 probably exists there also, as it extends into California, Arizona, and on the peninsula. (See notes on it.)

In reviewing this catalogue we find the terrestrial species to be thirty-two, of which fourteen are found on both sides of the boundary line. The fresh-water species are but eleven (or twelve counting No. 37), and all but this and perhaps 36 cross the boundary. Thus there remain, not found northward, eighteen land species, and one or two fresh-water.

Those also found on the east side of the gulf, or further south, are four or five land and four fresh-water. The total number given, including marine, is fifty-three, of which fourteen are considered peculiar to the peninsula, and two are reported as Chilian also (included in those more southern). Of the peculiar forms eight are Bulimoid, and four Helicoid. The derivation of these, peculiar to the peninsula, will in future be an interesting subject for investigation.

In referring to Lower California as "the Peninsula" it is most correct to include in it only the regions south of the mouth of the Colorado River, about lat. 31° 30′, which excludes the Desert species and also Nos. 15, 18, 24, 25, 26, 27, as their range is now known.

The local distribution of the species depends on latitude, altitude and exposure to the gulf on the east, or the ocean on the west. The gulf having heated water and tropical marine mollusca, besides having its shore protected from the ocean winds by high mountains, shows the greatest number of tropical species on land, the same species sometimes extending four or five degrees of latitude farther north than on the west coast. It is doubtful if any but Helicoid species are found on the west coast north of lat, 25°, while those of the east coast are mostly Bulimoid. Nos. 20 and 23 are the most southern of the former on east side, at lat. 26° 52′, about 280 miles north of Cape St. Lucas. Very much yet remains to be learned regarding distribution of the species.

The most remarkable instance of peculiar distribution is that of the three or four species inhabiting Guadelupe Island, on which we might expect a much larger number to occur, judging from most

other islands, especially those nearer the coast northward, except Cedros Island, which furnishes but one, while Coronados Islands have two, and the Santa Barbara group two to seven each, of which nearly all are absent from the main land. Guadelupe, 100 miles off shore, and volcanic, has been stocked by chance importations from the latter group (No. 21), the peninsula (1, 23, 20?), and the last three are the only species said to be common to the peninsula and the main land of Mexico. The relation of these facts to the distribution of the species, may be perhaps explained by the small shells most easily adhering to birds roosting on the ground.

MARIPOSA COUNTY AS A BOTANICAL DISTRICT.

II.

BY J. W. CONGDON.

In mentioning in the former article the shrubs forming the bulk of the chaparral of the wooded foothills, the Christmas Berry (*Heteromeles arbutifolia*) was accidentally omitted. Its abundant and beautiful bunches of red berries are very noticeable, in the winter, on nearly all our hillsides.

In discussing the herbaceous vegetation of this zone, it has seemed to me, that instead of giving a mere enumeration of peculiar or interesting plants, there would be some real scientific value in a somewhat detailed comparison of its flora with the flora of the corresponding portion of the Coast region. I include under the latter designation the territory between the Coast line and the western edge of the San Joaquin plain, with the Bay of Monterey for its southern and Mendocino County for its northern boundary.

Perhaps the most interesting and significant result of such a comparison is the great number of common species found in these tracts separated from each other by the wide expanse of the San Joaquin plain, here of an average width of at least forty-five miles. This intervening plain has a vegetation of its own, consisting of the most common Californian types, mingled with a few peculiar forms limited to that region, and it therefore constitutes with its western boundary of the interior Coast Range a real interruption of the continuous distribution of the great majority of these common species.

In the annexed list of species common to these two districts, introduced plants are indicated by putting the specific name in italics. P, denotes that the plant is also found on the San Joaquin plain; C, denotes that it extends up into the Coniferous zone; and S, that it reaches the Subalpine region.*

Clematis ligusticifolia Nutt. C.
lasiantha Nutt.
Thalictrum polycarpum Wats. C.
Ranunculus aquatilis L. P.
Californicus Benth. C.
hebecarpus H. & A. P.
Aquilegia truncata F. & M. C.
Delphinium hesperium Gray. C.
variegatum T. & G. P.
Berberis repens Lindl. C.
Platystemon Californicus Benth. P.
Platystigma Californicum Benth. & Hook.
Meconopsis heterophylla Benth. P.
Eschscholtzia Californica Cham. P.
Dendromecon rigidum Benth. C.
Dicentra chrysantha, H. & A.
Cardamine oligosperma Nutt.
Arabis perfoliata Lam.
Erysimum asperum DC. C. S.
Sisymbrium *officinale* Scop. P.
canescens Nutt. C.
Barbarea vulgaris R. Br. (Clearly native.)
Tropidocarpum gracile Hook. P.
Capsella *Bursa-pastoris* Moench. C. P.
Lepidium nitidum Nutt. C. P.
Thysanocarpus curvipes Hook. P.
laciniatus Nutt.
pusillus Hook.
Helianthemum scoparium Nutt. Chemisal.
Silene *Gallica* L. P.

*Nearly all the localities and habitats given in these articles are derived from the personal observations and knowledge of the writer. When the fact is otherwise, the authority relied upon will be given.

Silene Californica Durand. C.
Stellaria *media* L. P. C.
nitens Nutt. P.
Arenaria Douglasii T. & G.
Californica Brewer.
Calandrinia Menziesii Hook. P. C.
Claytonia perfoliata Don. P. C.
exigua T. & G.
Montia fontana L.
Hypericum concinnum Benth. (Abundant with chemisal.)
anagalloides C. & S. C. S.
Malva *borealis* Wallman. P. C.
Sidalcea malvæflora Gray. C.
humilis Gray. P.
Geranium Carolinianum L. C.
Erodium *cicutarium* L'Her. P. C.
moschatum L'Her. P.
Botrys Bertolini. (Becoming very abundant.)
Limnanthes alba Hartweg. P.
Oxalis *corniculata* L. P.
Rhamnus crocea Nutt.
Californica Esch.
var. tomentella Wats.
Ceanothus sorediatus H. & A. Chemisal.
divaricatus Nutt. C.
cuneatus Nutt. C.
Vitis Californica Benth. P.
Æsculus Californica Nutt. C.
Acer macrophyllum Pursh. C.
Rhus diversiloba T. & G. C.
aromatica Ait.
var. trilobata Gray.
Lupinus Chamissonis Esch. C.
rivularis Dougl. C.
albicaulis Dougl. C. S.
nanus Dougl. P. C.
micranthus Dougl. P. C.
var. bicolor Wats. C.
leptophyllus Benth.

Lupinus densiflorus Benth. P. C.
Trifolium Macræi H. & A. P.
gracilentum T. & G.
ciliatum Nutt. C.
involucratum, Willd. P. C.
tridentatum Lindl. P. C.
pauciflorum Nutt. C. S.
microcephalum Pursh.
depauperatum Desv.
Melilotus *parviflora* Desf. P.
Medicago *sativa* L. P.
denticulata Willd. P. C.
Hosackia gracilis Benth.
strigosa Nutt. P.
parviflora Benth.
Purshiana Benth. P. C.
subpinnata T. & G. P.
brachycarpa Benth. P.
glabra Torr.
Psoralea orbicularis Lindl. C.
macrostachya DC. C.
Vicia Americana Muhl. and vars. C.
Prunus subcordata Benth. C. S.
demissa Walp. C. S.
Nuttallia cerasiformis T. & G.
Rubus ursinus C. & S. C.
Potentilla glandulosa Lindl. C.
Horkelia Californica C. & S.
Adenostoma fasciculatum H. & A.
Alchemilla arvensis Scop. P.
Rosa Californica C. & S. C.
Heteromeles arbutifolia Brewer.
Saxifraga integrifolia Hook. C. S.
Tellima heterophylla H. & A. (Mostly form with entire petals.)
affinis Boland.
Heuchera micrantha Dougl. C.
Ribes Menziesii Pursh. C.
Cotyledon farinosa Benth. & Hook. C.
Lythrum alatum Pursh. var. linearifolium Gray. C.

Zauschneria Californica Presl. C. S.
Epilobiun coloratum Muhl. var. occidentale Wats. C. S.
paniculatum Nutt. C.
Œnothera biennis L. var. grandiflora Lindl.
graciliflora H. & A. P.
dentata Cav. C.
Godetia lepida Lindl. and vars. C. S.
viminea Spach.
Clarkia elegans Dougl.
Boisduvalia densiflora Wats. P. C.
Mentzelia lævicaulis T. & C.
Megarrhiza Californica Torr. P.?
Mollugo verticillata L. P.
Bowlesia lobata Ruiz & Pav.
Eryngium petiolatum Hook. var. armatum Wats.
Sanicula Menziesii H. & A.
bipinnatifida Dougl. P.
Carum Gairdneri Benth. & Hook. C. S.
Œnanthe Californica Wats. C.
Peucedanum utriculatum Nutt. P.
macrocarpum Nutt.
dasycarpum T. & G.
Daucus pusillus Michx. P.
Aralia Californica Wats. C.
Sambucus glauca Nutt. C.
Symphoricarpus racemosus Michx. C.
Lonicera hispidula Dougl.
Cephalanthus occidentalis L. P.
Galium Aparine L.
Valerianella (Plectritis) congesta Lindl. C.
Californica Gray.
Brickellia Californica Gray.
Gutierrezia Euthamiæ T. & G.
Grindelia robusta Nutt. var. rigida Wats. P.
Lessingia Germanorum Cham.
leptoclada Gray. C.
Solidago occidentalis Nutt. P.
Californica Nutt. C.
Aster Chamissonis Gray. C.

Erigeron foliosus Nutt. var. stenophyllus Gray. C.
Philadelphicus L. C. S.
Canadensis L. P. C.
Bigelovia arborescens Gray. (Chemisal.)
Micropus Californicus F. & M. P.
Psilocarphus tenellus Nutt. P. C.
Stylocline gnaphalioides Nutt.
Filago Californica Nutt.
Anaphalis margaritacea B. & H.
Gnaphalium decurrens Ives. C.
Sprengelii H. & A.
microcephalum Nutt. C.
palustre Nutt. P. C.
Xanthium *strumarium* L. P.
spinosum L. P. C.
Wyethia helenioides Nutt.
Helianthella Californica Gray. C.
Helianthus *annuus* L. P.
petiolaris Nutt. P. C.
Californicus DC. C.
Leptosyne Stillmani Gray.
Madia elegans Don. P. C.
sativa Molina var. typica. C.
var. racemosa. C.
var. dissitiflora. C.
filipes Gray. P. C.
Hemizonia Fitchii Gray.
pungens T. & G. (Waif.) P.
multiglandulosa Gray. P. C.
var. villosa. C.
Lagophylla ramosissima Nutt.
Layia gaillardioides H. & A. C.
Achyrachæna mollis Schauer.
Bæria gracilis Gray. P.
uliginosa Gray. P.
Eriophyllum confertiflorum Gray. C.
cæspitosum Dougl. C. S. Alpine.
Rigiopappusleptocladus Gray. P.
Achillea millefolium L. C. S.

Anthemis *Cotula.* C. P.
Matricaria *discoidea* DC. P.
Artemisia Ludoviciana Nutt. C. S.
dracunculoides Pursh. C.
Senecio *vulgaris* L. P.
Douglasii DC. P. C.
aronicoides DC. C. S.
Cnicus Californicus Gray? C. S.
Centaurea *solstitialis* L. P.
Melitensis L. P.
Microseris aphantocarpha Gray. P.
Bigelovii Gray. P.
linearifolia Gray. C.
Stephanomeria paniculata Nutt.
Rafinesquia Californica Nutt.
Hypochæris *glabra L.*
Troximon grandiflorum Gray. C.
heterophyllum Greene. P.
Hieracium albiflorum Hook.
Sonchus asper Vill. P.
Arctostaphylos tomentosa Dougl. C.
pungens HBK. C. S.
Dodecatheon Meadia L. C. S. Alp.
Fraxinus Oregana Nutt.
dipetala H. & A.
Apocynum cannabinum L.
Asclepias Mexicana Cav. (fascicularis Decaisn). P. C.
vestita H. & A. P.
Collomia gracilis Dougl. P. C.
Gilia pusilla Benth. var. Californica Gray. P. C.
dichotoma Benth.
micrantha Steud.
androsacea Steud.
tenella Benth. P.
cotulæfolia Steud. C.
intertexta Steud. C.
achilleæfolia Benth. P. C.
tricolor Benth. P.
inconspicua Dougl. C.

Nemophila aurita Lindl.
maculata Benth. P.
insignis Dougl. P. C.
Menziesii H. & A. P.
parviflora Dougl. P. C. S.
Phacelia circinata Jacq. f. C. S.
tanacetifolia Benth. P.
Emmenanthe penduliflora Benth.
Eriodictyon glutinosum Benth.
Heliotropium Curassavicum L., P.
Amsinckia spectabilis F. & M. P. C. Y.
intermedia F. & M. P.
Krynitzkia Californica Gray. P. C.
oxycarya Gray. P. C.
Plagiobothrys rufescens F. & M. P.
canescens Benth. P. C.
Pectocarya linearis DC. P.
Convolvulus luteolus Gray.
occidentalis Gray.
Cuscuta Californica Choisy. P. C.
subinclusa Dur. & Hilg. C.
Solanum nigrum L. P.
umbelliferum Esch.
Nicotiana Bigelovii Wats. P.
glauca Graham.
Scrophularia Californica Cham. C.
Collinsia bicolor Benth.
parviflora Dougl. P. C.
Penstemon breviflorus Lindl.
Mimulus Douglasii Gray. P.
glutinosus Wendl.
cardinalis Dougl. C.
luteus L. P. C.
pilosus Watson. C. P.
Veronica peregrina L. P.
Castilleia foliolosa H. & A. (Chemisal.)
parviflora Bong. C.
Orthocarpus attenuatus Gray. P.
purpurascens Benth. P.

Orthocarpus erianthus Benth. P.
Cordylanthus filifolius Nutt. C.
pilosus Gray. C.
Pedicularis densiflora Benth.
Aphyllon fasciculatum Gray. C.
Californicum Gray.
Monardella villosa Benth.
Pogogyne Douglasii Benth. P. C.
serpylloides Gray. P.
Sphacele calycina Benth.
Salvia Columbariæ Benth.
Scutellaria angustifolia Benth.
tuberosa Benth.
Marrubium *vulgare* L. P. C.
Stachys albens Gray. C.
Trichostema lanceolatum Benth. P.
Plantago *major* L. P. C.
lanceolata L. C.
Patagonica Jacq. P. C.
Rumex salicifolius Weinm P.
crispus L. P. C.
conglomeratus Murr. C.
Acetosella L. P. C.
Polygonum *erectum* L. P. C.
aviculare L. P. C.
nodosum Pers.
Persicaria L. P. C.
Convolvulus L. C.
Eriogonum nudum Dougl. C. S.
virgatum Benth. P. C.
vimineum Dougl. P. C. S.
Lastarriæa *Chilensis* Remy. P.
Pterostegia drymarioides F. & M. P. C.
Amarantus *retroflexus* L. P. C.
paniculatus L. C.
albus L. P. C.
blitoides Wats.
Chenopodium *album* L. P. C.
murale L. P. C.

Chenopodium leptophyllum Nutt. P.
Botrys L. P. C.
ambrosioides L. P. C.
Umbellularia Californica Nutt. C.
Urtica holosericea Nutt. P. C.
urens L. P.
Eremocarpus setigerus Benth. P. C.
Euphorbia serpyllifolia Pers. P.
leptocera Engelm. C.
Callitriche verna L. P. C.
Alnus rhombifolia Nutt. C.
Salix nigra Marsh. P. C.
longifolia Muhl. P. C.
lævigata Bebb. P.
lasiolepis Benth. P. C.
Populus Fremontii Wats. P.
Quercus lobata Née. C.
Douglasii H. & A.
chrysolepis L. C.
Kelloggii Newberry. C.
Phoradendron flavescens Nutt.
Juniperus Californica Carr.
Pinus Sabiniana Dougl.
Sisyrinchium bellum Wats.
Allium attenuifolium Kell.
Brodiæa capitata Benth. P. C. S.
laxa Wats. C.
ixioides Wats. C.
lactea Wats.
Chlorogalum pomeridianum Kunth. C.
Fritillaria biflora Lindl.
lanceolata Pursh, *var.* floribunda Benth.
atropurpurea Nutt. C.
Calochortus albus Dougl.
luteus Dougl.
venustus Benth. C. S.
Lemna minor.
Zannichellia palustris L.
Potamogeton pauciflorus Pursh.

Luzula comosa Meyer. C. S.
Juncus Leseurii Boland. P.
effusus L. C.
bufonius L. P. C.
tenuis Willd.
Carex marcida Boott. C. S.
glomerata Thunb.
angustata Boott. C.
Panicum *sanguinale* L. P. C.
dichotomum L. C.
crus-galli L. P.
Phleum *pratense* L. P.
Polypogon *Monspeliensis* Desf. P. C.
littoralis Smith. P. C.
Agrostis *alba* L. P. C. S. Native. S.
scabra Willd. C. S.
Gastridium australe Beauv. P. C.
Stipa setigera Presl. C.
eminens Cav.
viridula Trin. C.
Avena *fatua* L. P. C.
Aira danthonoides Trin. C. S.
Holcus *lanatus* L. P. C.
Melica imperfécta Trin. C.
var. refracta Thurb.
bulbosa Geyer. C.
Atropis tenuifolia Wats. C.
Poa annua L. P. C.
Poa pratensis L. P. Native. C. & S.
trivialis L. C. Apparently native.
Festuca *Myurus* L. P. C.
microstachys Nutt. P. C.
Bromus *maximus* Desf. P. C.
rubens L. P. C.
secalinus L. P. C.
racemosus L. P. C.
Ceratochloa *unioloides* Beauv. P.
Lepturus Bolanderi Thurb.
Hordeum *nodosum* L. C.

Hordeum *murinum* L. P. C.
Elymus condensatus Presl. C.
Sibiricus L. C. S.
Sitanion Schult. P. C.
Polypodium vulgare L. C. S.
Gymnogramme triangularis Kaulf. C. S.
Pellæa andromedæfolia Fee. C.
Ornithopus Hook. C.
Pteris aquilina L. C.
Woodwardia radicans Sm. C.
Aspidium rigidum Sm. C. S.
munitum Kaulf. C.
Cystopteris fragilis Bernhardi. C. S.
Selaginella rupestris Spreng. C. S.
Azolla Caroliniana Willd. P.

This list shows that out of 318 native species common to this district and the coast, as above defined, only 105, or about one-third, are found in the intervening plain. It is possible, but not probable, that a more thorough exploration of the plains would add something to the number of the species found there, but could hardly produce any serious change in the ratio. On the other hand, out of the 66 naturalized plants enumerated, 59 are pretty certainly found on the plains, showing that they have accompanied the successive waves of immigration which first swept over the foothills in the search for gold, but have now largely flowed back upon the plains, seeking the agricultural treasures of the soil.

A further examination of the same list shows how rapidly the plants of the plains and lower foothills disappear as we ascend into mountains. Of the 105 plants of the plains found in this zone, only 37 reach the coniferous belt and only three the subalpine district. Probably there are really only two of these, as *Achillea millefolium* is pretty certainly naturalized on the plains, having been introduced with grass seed. Out of the 213 remaining species 115 extend into the coniferous belt, of which 27 reach the subalpine region. Two of these, *Dodecatheon Meadia* and *Eriophyllum cæspitosum*, attain the alpine summits in some of their varieties which, however, may yet be specifically distinguished from the lower forms.

Coming now to the species really characteristic of or limited to

the foothills, which are found in this zone, so far as they are known to me, they will be found in the next list, which follows the same rule as the former one, except that items of supposed interest in regard to rare or new species are more freely introduced.

Isopyrum occidentale H. & A. Shaded hillsides. Mariposa.
Delphinium decorum F. & M., var. patens Gray. Same localities. C.
Arabis arcuata Gray. Face of cliffs. Mariposa. Hite's Cove. C.
Streptanthus barbatus Wats.? Sepals not bearded. Rocky places. Mariposa. Agua Fria.
polygaloides Gray. Rocky sidehills. Mariposa.
Nasturtium palustre DC. Banks Lower Merced.
Lepidium Menziesii DC. The common species here.
Thysanocarpus radians Benth. Hornitos.
Viola aurea Kell. The only yellow violet proper here. C. S.
chrysantha Hook. This beautiful representative of the *tricolor* type is not rare in open grassy places in March.
Polygala Californica Nutt. Rocky cliffs. Merced River.
Hypericum Scouleri Hook. Stream banks. C.
Sidalcea Hartwegi Gray. Thickets and open grounds.
Fremontia Californica Torr. Chaparral-covered hillsides. May. C.
Linum micranthum Gray. Rocky places.
Trifolium bifidum Gray. Differs from *T. gracilentum* in its strictly upright growth. Open woods.
Hosackia stipularis Benth. Chemisal. Agua Fria.
grandiflora Benth. Shaded spots. Mariposa. April and May.
Hosackia argophylla Gray. Cliffs. Hite's Cove.
Astragalus Congdoni Wats. Chemisal. Hite's Cove.
Lathyrus sulphureus Wats. Thickets and stream banks. Common. C.
Cercis occidentalis Torr. Rocky places. A white variety occurs. March and April.
Cercocarpus parviflorus Nutt. Frequent. March.
Calycanthus occidentalis W. & A. Rocky beds of streams. Hite's Cove, etc. C.

Saxifraga Parryi Gray. Rocky banks of Merced River and vicinity of Benton Mills. This is an interesting link between our flora and that of the extreme southwestern coast of the State.

Philadelphus Lewisii Pursh. Rocky banks of streams. Frequent.

Ribes leptanthum Gray. Rocky places, descending almost to the plains. December to March.

Sedum obtusatum Gray. Rocks. Not rare. C.

pumilum Benth. Rocks near Hornitos and Mormon Bar. March and April.

Epilobium minutum Lindl. Wooded places. Common.

Godetia. A form classed by Watson as a var. of *epilobioides*, but clearly different. Thickets. Common. C.

epilobioides Wats. Rocky places. Not rare.

biloba Wats. North hillsides. Mariposa.

Boisduvalia Torreyi Wats. Stream beds. Mariposa. Frequent.

Heterogaura Californica Rothr. Shady rocky places. Frequent. C.

Datisca glomerata B. & H. Banks of streams. Frequent.

Mentzelia dispersa Wats. Shady hillsides. Mariposa. Occasional.

Lindleyi T. & G. Cliffs. Hite's Cove. March.

Cucurbita perennis Gray. Occasional. Perhaps introduced near the plains.

Sanicula bipinnata H. & A. Rocky places. Common.

tuberosa Torr. Shady hillsides. March and April.

Deweya Hartwegi Gray. Cliffs. Hite's Cove, Benton Mills, etc. April.

Osmorrhiza brachypoda Torr. Woods. Common. C.

Podosciadium Californicum Gray. Rocky beds of streams. White's Gulch. May.

Peucedanum caruifolium T. & G. Rocky places. Common.

Ferula dissoluta Wats. Rocky places. Mariposa, Agua Fria, etc. April.

Caucalis microcarpa H. & A. Dry rocky places. Common.

Cornus glabrata Torr. Banks of streams. Scarce.

Galium Bolanderi Gray. Thickets. Everywhere. C.

Pentachæta exilis Gray, *var.* discoidea Gray. Open grassy places. March and April.

Lessingia nana Gray. Open grassy ground. Mariposa. August and September.

Corethrogyne filaginifolia Nutt, *var.* tomentella Gray. Hite's Cove. October and later.

Stylocline filaginea Gray. Benton Mills. April.

Evax caulescens Gray. Clayey ground. Common.

Balsamorrhiza Bolanderi Gray. Dry summits of chaparral-covered hills. Bear Valley Mt., etc. April.

Wyethia, related to *W. angustifolia*, and referred to under that species in Bot. Cal. Dry woods. C.

Hemizonella Durandi Gray. Dry ground. Benton Mills, etc. C.

Hemizonia virgata Gray. Is *the* tar weed, here, covering all the open grounds in August and September.

Wrightii Gray. Adventive from below, especially near the plains.

mollis Gray. Open grounds. Most common near and in the coniferous belt. C.

truncata Gray. Rocky sidehills. Mariposa.

Lagophylla glandulosa Gray. Open clayey grounds and roadsides. Mariposa and vicinity. May to December.

filipes Gray. Rocky beds of streams. Gaudalupe mountain, etc. May—July.

Layia Fremontii Gray. Open grassy places towards the plains. March.

Bæria debilis Greene. Shade of chaparral bushes. Lewis'. April.

Chænactis glabriuscula DC. Clayey soils. Frequent.

Helenium Bigelovii Gray. Rocky beds of rivers. Benton Mills and above. C. S.

Troximon retrorsum Gray. Shaded hillsides. Mariposa, and more common in the zone above. C. S.

Nemacladus ramosissimus Nutt. Rocky soils, nearly the same range as the last. C.

Githopsis specularioides Nutt. Wooded hillsides. Common.

Heterocodon rariflorum Nutt. Rocky and wet places. Not rare.

Arctostaphylos glauca Lindl. Mariposa. More common here than *A. pungens*, which grows principally higher up.

Gomphocarpus tomentosus Gray. Rocky hillsides. Benton Mills, etc.

cordifolius Benth. Open thickets. Common.

Asclepias speciosa Torr. Open grounds. A rather showy species. More common in the next zone. Stockton, etc. C.

Erythræa venusta Gray. Water courses. Frequent. More abundant in the zone above. C.

Gilia Bolanderi Gray. Open clayey grounds. Mariposa, etc. Scarce.

filicaulis Torr. Dry hillsides. Mt. Bullion, etc. Not common.

Ellisia membranacea Benth. Open rocky places near the plains.

Phacelia humilis T. & G. Rocky shaded places. Mariposa and above. C. S.

hispida Gray. Rocks. Agua Fria, etc. March.

phyllomanica Gray (or bipinnatifida). Shaded rocks. Mariposa, etc.

Plagiobothrys tenellus Gray. Moist grounds. Frequent. C.

Torreyanus Gray. Same localities. C.

muriculatus. Wooded hillsides. C.

barbigerus Gray. Open shady places. Darrah Road, etc. C.

sparsiflorus Greene. Rocky banks of streams. Mormon Bar.

Echinospermum Greenei Gray. Open grassy places. Mariposa.

Cynoglossum læve Gray. Moist hillsides. April.

Pectocarya pusilla Gray. Clayey soils near Mariposa. April.

Datura meteloides DC. Stream beds. Probably introduced from below.

Verbascum *Thapsus* L. This common eastern weed is fast becoming too frequent in Mariposa county. C.

Antirrhinum leptaleum Gray. Open and especially cultivated grounds. Mariposa and above. C.

Breweri Gray. Occasional on hillsides, near Mariposa.

Collinsia tinctoria Hartg. Wooded hillsides and stream banks. Mariposa and above. C.

Penstemon heterophyllus Lindl. Open grounds, Mariposa, etc.

azureus Benth. Higher up. Probably a form of the last. C.

Mimulus nanus Hook. & Arn. Wooded hillsides. Mariposa and above. C.

Mimulus Congdoni Robinson. Shade of buckthorn clumps. Mariposa and vicinity. March.

Torreyi Gray. Wooded hillsides and wet grounds. Mariposa and above. C. S.

Bolanderi Gray. Open clayey soils. Hite's Cove. Mariposa and above. C.

gracilipes Robinson. Rich rocky soils. Mormon Bar and above. April.

Pulsiferæ Gray. Moist grounds. Bootjack Ranch. More common above. C. S.

inconspicuus Gray. Wooded hillsides. Mariposa and above. C.

Palmeri Gray. Banks of streams. Rare near Mariposa. Occasional above. C.

floribundus Dougl. Rocky beds of streams, etc. Very frequent. C. S.

Orthocarpus Bidwelliæ Gray. Open spots in chaparral. Darrah Road.

spec. undescribed. Mariposa and above. Rocky hillsides. March.

Cordylanthus tenuis Gray. Clayey soils. Darrah Road.

Pycnanthemum Californicum Torr. Banks of streams. Mariposa and above. C.

Monardella lanceolata Gray. Open uncultivated grounds. Mariposa and above. C.

candicans Benth. Occasional in open spaces in the chaparral. Mariposa, etc.

Scutellaria Bolanderi Gray. Banks of streams. Mariposa, and more common above. C.

Trichostema oblongum Benth. Beds of streams. Mariposa Creek, etc.

Eriogonum stellatum Benth. Rocky places. Josephine Mine. More common above. C. & S.

hirtiflorum Gray. Open clayey soils. Hite's Cove. Mariposa, etc.

Chorizanthe membranacea Benth. Rocky places. Hite's Cove. Agua Fria, etc.

Hesperocnide tenella Torr. Shaded rocks. Mormon Bar, etc. April.

Euphorbia ocellata D. & H. Open clayey soils. Mariposa and below.

dictyosperma P. & M. Open hillsides. Mariposa, etc.

Quercus Wislizeni ADC. Dry wooded hillsides, almost everywhere below the evergreen belt.

Asarum Hartwegi Wats. Rocky places. Mariposa, etc. April.

Arceuthobium occidentale Engelm.? Everywhere on *Pinus Sabiniana*. C.

Pinus ponderosa Dougl. Begins here but reaches its grandest development in the zone above. C. S.

Allium hyalinum Curran. Rocky places. Mariposa, etc. April. Two weeks earlier than the associated *A. attenuifolium* Kell.

Brodiæa grandiflora Sm. Open grounds. Mariposa, etc. Frequent. May to June.

Stropholiron Californicum Torr. Climbing over the bushes everywhere from Mariposa, etc., above. The leaves die early. C.

Fritillaria atropurpurea Nutt. Shaded hillsides and deep woods. Mariposa and above. C.

Erythronium Hartwegi Wats. Shaded hillsides, principally near Mariposa. April. This is the most appropriate "Mariposa Lily."

Odontostomum Hartwegi Torr. Rocky beds of streams. Agua Fria. April and May.

Juncus Congdoni Wats. Bed of the Chowchilla, etc. April and May.

Cyperus aristulatus Roth. Beds of streams. Chowchilla and above. C.

Agrostis virescens HBK. Rocky banks of streams. Mariposa and above. C.

Cinna macroura Kunth. Rocky banks of streams. Mariposa and vicinity.

Triticum caninum L. Rocky banks of streams. Mariposa and above. C.

The 124 species above named illustrate the same fact as the former list, that the species change rapidly as we approach the mountains. Out of the whole number only 44 enter the coniferous belt, and of these only nine reach the subalpine region. Out of the 508

species enumerated in these two lists as constituting the flora of the wooded foothills, 440, or 87 per cent. nearly, are plants apparently native in the district, and about 13 per cent. are pretty certainly introduced, though some of these are native further south. Of the 440 native species 318, or a little over 72 per cent., belong also to the coast region, though only 105, or 24 per cent., occur in the intervening San Joaquin plain; while of the 122 native plants which begin to grow here, 78, or nearly 18 per cent., of the whole number are, in this county at least, limited to this zone.

NOTES ON LILIACEÆ. II.

BY CARL PURDY.

Every observing botanist recognizes the extent to which plants are influenced by surroundings. Climate, soil, exposures and moisture are factors which greatly effect the appearance of a plant, not only in a general way but also sometimes structurally.

In no country are there greater variations in natural surroundings than in California, and our flowers reflect their surroundings. It is indeed wonderful how different a species, which can be proved to be the same, will appear in different places. So different indeed that such forms are frequently given different botanical names and treated as distinct species. On the other hand it is not infrequent that careful botanists attribute to accidental circumstances a difference which really marks a variety or species. Between the extreme of considering each accidental variation a variety or species, and the other extreme of merging two distinct species under the idea that the variation is inconstant and accidental, lies a mean very difficult to obtain, and it is not surprising that so many errors have been made and obtained a stronghold in botanical works.

I suppose that no class of plants are more susceptible to the influence of surroundings than the Liliaceæ. I tried for years to satisfy myself as to whether species were distinct or not, by comparison of specimens and observations of the plants in their native homes, but I was forced to the conclusion that the only way to settle the matter was by cultivating them side by side, thus eliminating all variations due to soil and climate. This, rather than field work, is my present line of study, and carefully followed out will be, I feel sure, productive of valuable scientific results.

In this work I find two obstacles. The first is the difficulty of securing the bulbs. Of course the larger number can be obtained, but many species are only to be had by journeys to out of the way localities. It may be years before some can be secured. The cultivation of these bulbs is by no means a simple matter. It requires care and close study of conditions. I am pleased to say that I am now able to grow most species quite satisfactorily.

The problems to be solved are many. In Lilium, twelve or more species have been described from this coast. It is likely that cultivation will show the number of varieties to be much greater. In Calochortus, the field of work is large. There is much confusion here. I have no doubt but that several species will, in cultivation, prove to be identical. Here, as often elsewhere, the question arises as to what degree of variation justifies the formation of a species or variety, and how much greater the variation should be for one than the other. I should like to see this question discussed.

In the genus Calochortus it is peculiarly pertinent; since several so called varieties are as well defined as others called species, for instance, *Calochortus venustus*, *C. luteus*, and *C. luteus* var. *oculatus* and var. *citrinus*, following Botany of California, as to names. *C. luteus*, however, is a clearly defined species as to habit, gland, etc., and so is *C. venustus*, the latter much finer and larger in flower, more varied in markings and color. No one having seen either *C. luteus*, with its small flower, single color and peculiar gland, or *C. venustus*, with its markings and brilliancy, would hesitate to identify either anywhere.

Now, *C. luteus* var. *oculatus* and var. *citrinus* have the gland of *C. luteus* and that is all. In all other details their habit is that of *C. venustus*. While *C. luteus* var. *oculatus* and var. *citrinus* meet each other and cross in an interminable number of forms, I have never seen any tendency to cross with *C. luteus*. In fact, I have found the latter the least variable of species. In a field the flowers are alike, and those from far distant localities are identical. Is it not straining a point to refer two very distinct forms to a species that is invariable? To suppose them to have varied from *C. venustus* is still more of an improbability, since there are structural differences. I think they form a distinct species instead of varieties, and possibly two species.

In the genus Erythronium, botanists are still at sea, and all along the line of Liliaceæ there are interesting points to be solved.

NOTE ON HELIX YATESII Cooper.

BY HENRY HEMPHILL.

There seems to be an erroneous impression prevailing among our conchologists in regard to the habits of this interesting little mollusk that needs to be corrected. The fact that the five dead specimens—two perfect and three imperfect ones—from which Dr. Cooper drew his descriptions of the shell and his genus Ammonitella, were found in the cave at Cave City, Calaveras County, California, has led some of the writers on our West Coast shells to regard this mollusk as a rare, isolated cave dweller, that prefers the shadow and gloom of caverns in which to pass its existence, rather than the light of the outside world. This, however, is a mistake which any intelligent or close observing collector can easily determine by a visit to the cave, and a short ramble over the hills in its vicinity.

Several years ago I visited Calaveras County for the purpose of collecting this and the other shells of that region, and to my surprise I found this little mollusk near Murphy's, seven miles away from the cave, aestivating under stones on north hillsides, while numbers of dead shells lay bleaching in the sunshine, where they had fallen in the struggle for life.

Around the entrance and on the slopes of the hill in which the cave is situated, and also on the adjacent hills, it occurred plentifully, and it is not a rare shell in these localities.

On entering the cave I found but few specimens inside. Most of these I took from the crevices in the rocks on each side of the entrance within the cave, a few only being found on the floor, and none beyond a distance of fifty feet from the entrance, although I searched closely for this and other species with the aid of a good light.

When fairly within the cave, and looking towards the entrance, I could see the daylight through the crevices between the rocks on each side of the opening through which we entered, which at once revealed to me the mystery of the presence of this mollusk within this cool and shady retreat.

To those acquainted with the habits of land snails it will be readily seen how these creatures, in seeking safe and convenient places in which to hibernate and pass the long, dry and hot summer season and cold winter months, would naturally crawl into

these crevices between the shelving ledges, and finding them moist and cool, would continue their explorations until they entered the chambers of the cave; and thus having easy ingress and egress, they have no doubt continued their visits for many years, on the approach of the dry season, while some, perhaps, never leave the cave.

The fact that there are so few specimens found within the cave, and so many outside and miles away, æstivating under stones, is sufficient evidence that the presence of this mollusk within the cave is simply accidental, and that it is not its natural habitat.

In his remarks upon this shell, Dr. Cooper calls attention to its resemblance to Planorbis and Ammonite, its relations to *H.? polygyrella* and Gastrodonta, and its affinity to Macrocyclis, with all of which I agree, and which goes to show very plainly, I think, that nature does not represent any particular genus by the shell. If she indulges in such freaks as genera at all, she determines that matter by modifications of the structure of the animal, and not by the object formed or moulded by the animal itself; and this little shell, compounded of several so-called genera as it seems to be, is a good illustration of this fact.

In support of this I can do no better than repeat Dr. Cooper's own words: "It would have been supposed to be a Planorbis if found near water and if the streams in that country had not been thoroughly searched by many collectors. It resembles Planorbis in the inverted spire and in the partial enclosure of each whorl in the next larger, so that the spire shows only a small portion of the whole shell.

"The consequent vertical narrowing of the aperture, and, indeed, of the whole interior, is also found in some species of Planorbis, but not in any American Helicoid. Indeed, it is inconsistent with the character of 'Helix,' as defined by Lamarck, and this shell could not, therefore, be embraced in that most comprehensive genus. The resemblance to an Ammonite is conspicuous in a lateral view. It probably belongs to Helicellidæ, notwithstanding its thickened labrum, which we find also in *H. ? polygyrella* and *G. interna*, and some other species. Though toothless, it is apparently nearly allied to the former, in which the spire is flat and of 7 to 8 whorls. It also shows affinity to Macrocyclis in the oblique flattening of the outer whorls and its strong deflection near the mouth."

No stronger argument could be advanced to show how utterly valueless the shell is for the purpose of determining genera. Had this shell been accidentally washed into the creek below and found dead in the water as it was found in the cave, neither Dr. Cooper nor any other naturalist would have hesitated a moment to have described it as a Planorbis, which it closely resembles.

Even with the animal known, the authorities do not agree on its genera, or its position in our system of classification.

Mr. Tryon recognized Dr. Cooper's genus Ammonitella, but Mr. Binney, Mr. R. E. C. Stearns and Mr. Pilsbry, equally as good authority, refer the shell to Gonostoma.

Mr. Binney, than whom there is no better authority on these animals, says of Gonostoma: "Animal, as in Patula."

Now, if the animal is a Patula, should we not place this shell with or near the genus Patula, instead of separating it as we do now?

I do not write this in a spirit of criticism, but to draw attention to what I believe to be an error in our system of classification of these creatures, and which seems to me to be inconsistent with nature and the philosophy she teaches.

NOTES ON THE CICINDELIDÆ OBSERVED IN SAN DIEGO COUNTY, CAL.

BY F. E. BLAISDELL.

Omus. It is doubtful if any species of *Omus* occurs south of the 35th parallel. At Port Harford, San Luis Obispo County, I have taken what is probably *O. lecontei*, and I consider that locality the southern limit of distribution of the genus.

Cicindela latisignata Lec. Plentiful from May to October, on the ocean beach and alkaline flats; not found about inland streams and ponds.

Cicindela tenuicincta Schaupp. In company with the preceding form, with which it is identical. The creation of the present sub-species is ostensibly based upon the elytral markings. In *latisignata* there is an excessive increase in the white; while in *tenuicincta* there there is a close approach to the typical pattern as exhibited by *vulgaris* "the central pattern from which all forms observed in our Cicindelæ have been derived, either by a progressive spreading of the white, or its gradual absorption and fragmentation."—Horn.

From the above propositions, it is to be argued that *latisignata* has been evolved from *tenuicincta*, the latter being naturally and logically the fundamental species, the former only so by the arbitrary laws governing the priority of nomenclature.

Latisignata may be regarded as an incipient species in progress of divergence from a more normal type, and will in all probability in the course of time become isolated and perpetuated.

At the present time the two forms are to be considered as identical.

Any collector of these insects cannot fail to note the following facts while in the field:

1. That the two forms under consideration form the extremes of a series, in which the intermediate types of elytral variation are exceedingly abundant and exhaustive.

2. That the normal *tenuicincta* in numbers considerably exceed the broad-banded form, the latter being comparatively scarce.

3. That all of these forms are intimately associated.

4. That eight-tenths of the couples taken *in coitu* will represent a ♂ or ♁ of one of the extremes, with the opposite sex an intermediate.

From the above can be seen that they interbreed entensively, inhabit the same geographical region, and exist under the same environment and climatic conditions.

If any one of the forms inhabited a more or less distinct geographical district, so that it would be possible to admit of different climatic influences and environment, without constant interbreeding, the idea of races could be sustained.

Correctly and philosophically speaking, *Cicindela tenuicincta* is a fundamental species, with a strong tendency towards variation.

Cicindela obliquata Kirby. Occurs upon the borders of the Big Laguna, in Temecula Valley.

Cicindela vibex Horn. Ocean beach, near Oceanside.

Cicindela guttifera Lec. According to Schaupp's "Synopsis of the Cicindelidæ," this is the form that occurs throughout the county, about all the inland streams and ponds, as well as upon the ocean beach. In *12-guttata* the elytral markings are broken into spots. Specimens of *guttifera* taken in Arizona are quite green. This color begins to be perceptible in the specimens collected in the central portion of the county, becoming deeper as we approach the desert region and Colorado valley.

Cicindela hirticollis Say. Very abundant from June to October; varies in size without perceptible variation in elytral markings; occurs on ocean beach and alkaline flats; not inclined to inhabit the borders of inland fresh-water pools.

Cicindela sigmoidea Lec. A very abundant species, actually swarming on the bay beach during June and July. Attracted in considerable numbers by the electric light.

Cicindela gabbii Horn. Occurs in August on alkaline flats. Very desirable and not abundant.

Cicindela hæmorrhagica Lec. Occurs throughout the county. Formerly abundant about San Diego Bay, but has retreated before the advance of civilization, and at the present time is exceedingly rare.

Cicindela pacifica Schaupp. Occurs at Del Mar in August and September. From the sea-shore it extends up Peñasquitos Creek for the distance of fourteen miles to Poway (elevation 700 feet). Have not observed it at other inland points.

ADDITIONS TO THE CATALOGUE OF SAN FRANCISCO PLANTS.

BY KATHARINE BRANDEGEE.

6 *a*. RANUNCULUS BLOOMERI Gray. Bot. Cal. ii, 426. In wet adobe soil on the northern slopes and near the base of a high hill in South San Francisco. April—May.

31 *a*. *Lepidium bipinnatifidum* Desv. Jour. Bot. iii, 165. Common about roadsides and paths, South San Francisco. April—July.

47 *a*. STELLARIA LITTORALIS Torr. Pac. R. Rep. iv, 69. Bluffs above the sea at Land's End Station near Point Lobos. April—May. "Shore-Chickweed."

62 *a*. HYPERICUM SCOULERI Hook. Fl. Bor.-Am. i, 111. Lake View. April—July.

Ulex Europæus L.—"Gorse," "Furze," "Whin." This plant, native of Europe, has escaped and covers many acres near the county line, between Visitacion Valley and Ocean View. On the

bare stony hills it is low and decumbent, but in the ravines and sheltered spots it reaches 6–8 feet.

114 *a.* HOSACKIA STRIGOSA Nutt. T. & G. Fl. i, 326. Along the railway, Point Lobos. April—May.

142 *a.* TELLIMA AFFINIS (Gray. Proc. Am. Acad. vi, 534). The most common species in our limits. March—May.

153 *a.* CALLITRICHE SEPULTA Wats. Proc. Am. Acad. xiv, 298. Surface of mud about pools, Presidio. April—May.

ECHINOCYSTIS MARAH Wats. This species was supposed to be extinct within our limits, but it still persists in the gorse thickets near Visitacion Valley.

APIASTRUM ANGUSTIFOLIUM Nutt. T. & G. Fl. i, 644. Point Lobos, South San Francisco, Visitacion Valley. April—May.

204 *a.* GALIUM CALIFORNICUM H. & A. Bot. Beech. 349. South San Francisco, Visitacion Valley. April—June.

255 *a.* LAYIA CALLIGLOSSA var. OLIGOCHÆTA Gray. Fields at the upper end of Visitacion Valley. April.

285 *a.* *Cnicus arvensis* (L. spec. 1149.) About the base of Telegraph Hill. May—October. "Canada Thistle."

The spread of this plant is to be dreaded; though apt to be less troublesome in our dry climate than in the eastern states, it will be difficult to eradicate from irrigated fields and borders of ditches.

Centunculus minimus L. spec. 169. Cliffs between Lobos Creek and Fort Point, and very abundant about the Presidio in company with *Microcala quadrangularis*. April.

328 *a.* NEMOPHILA PARVIFLORA Benth. Trans. Linn. Soc. xvii, 275. Common in rocky bushy places. March—May.

329 *a.* NEMOPHILA AURITA Lindl. Bot. Reg. t. 1601. Near the northern base of a high hill in South San Francisco. April—May.

334 *a.* PHACELIA DOUGLASII (Benth. Trans. Linn. Soc. xvii, 276). Near Lake Merced. April—May.

370 *a.* ORTHOCARPUS ATTENUATUS Gray. Pac. R. Rep. iv, 121. Potrero. April.

372 *a.* ORTHOCARPUS FAUCIBARBATUS Gray. Pac. R. Rep. iv, 121. Presidio, Potrero, Visitacion Valley. April.

? EQUISETUM ARVENSE L. Marshy banks and ditch sides. Visitacion Valley.

NOTE ON A CALIFORNIAN LOLIGO.

BY HENRY HEMPHILL.

In the July (1891) number of the Nautilus, in an article under the heading "Edible Shell Notes," Mr. R. E. C. Stearns mentions a "Ten-armed Cephalopod" which he had seen offered as an article of food in the San Francisco markets. Recently, while passing through the San Francisco and Oakland markets, I found a form of a loligo lying on the stalls of the fish dealers, which they offered at twenty-five cents per pound, and which I think is the "Ten-armed Cephalopod" referred to by Mr. Stearns. Dr. Cooper informs me he had observed a shoal of loligo at Monterey, some years ago, but having no net he was unable to secure a specimen. These that we find here in the markets now are said, by the fish dealers, to be taken in nets outside the Heads by the Chinese fishermen.

The body and arms of my largest specimen measures about ten inches, the two longest arms being about three inches longer. The arms are not webbed, but each of the eight short ones have two rows of suckers their entire length, while the two other arms have a small patch of small suckers towards their tips. It took nine individuals of those I purchased from the fish dealer to weigh a pound, so we may say they weigh about two ounces each. In cleaning for cooking they will lose about half their weight, and each one will then furnish about one ounce of flesh.

In preparing them for cooking, after having removed the outer skin, pen, head, arms and entrails, they should be carefully washed, and fried in plenty of hot butter or fat, and seasoned to the taste.

Those which I had prepared and cooked were a little tough, though quite palatable, being nicely flavored, but they never will take the place of the delicious oysters and clams that have inspired poets to sing their praises.

In the form of its body and the coloring, as well as in the form of the pen, it closely resembles *Loligo Gahi* D'Orbigny, but as I have no other material with which to compare it, and no description of that form, I cannot say definitely whether it is that species or not. This form makes an interessing addition to our west coast Cephalopods, and if upon further study I should conclude it to be new I propose to call it *Loligo Stearnsii.*

The following is a list of all the Cephalopods known to our coast, from San Diego to Alaska:

ARGONAUTA ARGO L.
OCTOPUS PUNCTATUS Gabb.
AMMOSTREPHES AYRESII Gabb.
AMMOSTREPHES GIGANTEUS Gabb.
ONYCHOTEUTHIS FUSIFORMIS Gabb.

A NEW ASTRAGALUS.

BY SERENO WATSON.

ASTRAGALUS GRALLATOR n. sp. Perennial, the decumbent stems nearly two feet long, glabrous or nearly so: stipules distinct, acuminate-deltoid; leaves finely appressed-pubescent or glabrate, about 3 inches long; the narrowly oblong leaflets (about 20) 5 to 10 lines long: racemes loose, erect on peduncles exceeding the leaves; pedicels very slender, erect, 3 or 4 lines long: flowers small (3 lines long), pale rose-color or white; calyx-teeth narrow, shorter than the narrowly campanulate tube: pod (immature) 3 lines long, ascending upon a stipe nearly equalling the calyx, thin-coriaceous, nearly glabrous, transversely rugose, straight, 1-celled, at first compressed, becoming somewhat obcompressed-turgid, roundish dorsally and the ventral suture prominent.—At Steamboat Springs, Routt County, Colorado. Peculiar in its unusually long, slender pedicels, etc. In some respects it resembles species of the *Homalobi* section, but it is more nearly related to the *Bisulcati*, though the pod is not at all furrowed on the ventral side.

[The above Astragalus was found at Steamboat Springs in July, 1891, by the writer and sent to Dr. Watson for identification. It grew on the banks of a small stream in adobe soil, and has the odor of carrion peculiar to the Astragali that are found in similar localities. The flowers are white, but turn light pink in drying. It was a single plant, large and with many stems, and grew where *Astragalus Haydenianus* was very abundant. It was referred to in The Additions to the Flora of Colorada, Zoe, vol. ii, No. 3, as *A. Grayi.*

The manuscript was found by Mr. B. L. Robinson among Dr. Watson's papers and kindly sent to Zoe for publication.

ALICE EASTWOOD.]

THE LOCO WEEDS.

BY ALICE EASTWOOD.

Considering how much the loco weed has been the subject of discussions, experiments and even laws, it is surprising how little is really known about its identity, its properties and its effects. A survey of what has been done by chemists and other scientists seems only to increase the confusion. They disagree upon most important points, some asserting its poisonous character and proving it by experiments while others seem to be as positive that loco poison is a superstition of the farmer and stockman.

When a botanist tries to learn from the people of different localities which plant they regard as loco, he finds that each district has its own loco weed, and he is soon at sea amid the genera and species of Leguminosæ and also of other orders of plants. However, they all firmly believe that such a weed exists and they positively know that it destroys their cattle and horses. They will generally tell the inquirer that loco means crazy, and that when a horse becomes locoed he takes every little irrigating ditch for a river and every ant hill for a mountain.

The object of this paper is not to clear the mystery by an account of original experiments or by the elaboration of new theories. To briefly set forth what has been learned, so as to form a basis for observation and research, is all that will be attempted.

Until recently, botanists have recognized only *Astragalus mollissimus* and *Oxytropis Lamberti* as loco weeds; but now *Astragalus Mortoni*, *Crotalaria sagittalis*, *Hosackia Purshiana*, *Sophora sericea*, *Oxytropis deflexa*, *O. multiflorus*, *Malvastrum coccineum* and *Corydalis aurea* var. *occidentalis*, are all under the ban. F. W. Anderson, in an article in the Botanical Gazette for July, 1889, adds *Leucocrinum montanum*, *Fritillaria pudica* and *Zygadenus elegans*. The first is common around Denver in the early spring, and is generally considered harmless to stock beyond tainting the milk of the cows that feed upon it before the grass comes.

Professor L. E. Sayre of the Department of Pharmacy of the Kansas State University, made a chemical examination of the leaves of a loco plant, which he failed to name, and his report was published in the Druggists' Bulletin, May, 1889. The results were unsatisfactory, some slight evidences of a toxic alkaloid being discovered.

Dr. Isaac Ott, in the American Journal of Pharmacy, tells of his experiments on frogs and other lower animals with an alkaloid which he obtained from *Astragalus mollissimus.* He formulates its action as follows: "1. It decreases the irritability of the motor nerves. 2. It greatly affects the sensatory ganglia of the central nervous system, preventing them from receiving impressions. 3. It has a spinal tetanic action. 4. It kills mainly by arrest of the heart. 5. It increases the salivary secretion. 6. It has a stupefying action on the brain. 7. It reduces the cardiac force and frequency. 8. It temporarily increases arterial tension and finally decreases it. 9. It greatly dilates the pupil of the eye." Professor Sayre tried the effect of a concentrated solution of this drug upon himself, commencing with a small amount but increasing to a dose of an ounce every three hours. He perceived no effects except a slight stimulation of the stomach and circulation. During the summer of 1887 and 1888 he traveled through Indian Territory, Kansas, Colorado and New Mexico, inspecting the herds, but did not find a single animal having the symptoms commonly ascribed to the locoed. Professor Sayre is strongly of the opinion that the effects attributed to loco must come from some other cause.

Dr. Mary Gage Day, in an article in the New York Medical Journal, describing a series of experiments carried on for a year and a half, arrives at a different conclusion. She made a decoction of roots, stems and leaves, and daily gave sixty or seventy cubic centimeters to a half-grown vigorous kitten while plenty of milk and other food was also supplied. She thus describes the results: "The kitten became less active, the coat grew rough, appetite for ordinary food diminished and fondness for the loco increased, diarrhœa came on and retching and vomiting occasionally occurred. The expression became peculiar and characteristic. Emaciation and the above symptoms progressively increased until the eighteenth day, when periods of convulsive excitement supervened. At times the convulsions were tetanic in character; frothing at the mouth and throwing the head backwards as in opisthotonos were marked. At other times the kitten would stand on its hind legs and strike the air with its fore paws, then fall backward and throw itself from side to side. These periods of excitement were followed by perfect quiet, the only apparent sign of life being the respiratory movements. After a short interval of quiet the convulsive movements

would recur. These alternate periods of excitement and quiet lasted thirty-six hours, when the posterior extremities became paralyzed and the kitten died about two hours afterwards. There was no apparent loss of consciousness before death. The post-mortem examination revealed the presence of ulcers in the stomach and duodenum. The heart was in diastole; brain and myelon appeared normal. As might be expected from the emaciation the entire body was anæmic."

She tried the same experiment on a vigorous full-grown cat with the same results. Two strong young cats were confined and treated exactly the same, except that one was given a decoction of loco daily. The latter became diseased while the other remained healthy. The cats acquired a decided liking for the new drink and would beg for it as for milk. To discover its effects upon an herbivorous animal she tried feeding fresh loco to a young jackrabbit that had been captured. After refusing the weed for a short time it began to relish it and eat it as eagerly as grass. In about ten days the rabbit was found dead with its head thrown back and stomach ruptured. She thinks that the plant is more poisonous in the fall and winter, after the seeds have ripened. The plants used in her experiments were *Astragalus mollissimus* and *Oxytropis Lamberti.* These are her final conclusions: "I. That there is some poison in loco weed which may cause the illness, and, if sufficient quantity is taken, the death of an animal. II. This poison is contained in the decoction obtained from the plants, and by systematically feeding it to healthy cats cases of loco disease may be produced. III. Taste for the green loco weed may be experimentally produced in the jackrabbit (an animal indigenous to Kansas). IV. From the large quantity of the plant or decoction required to produce the disease, the poison must be weak, or, if strong, it must be in a very small amount."

Dr. Day's conclusions are certainly the more convincing, for her experiments were kept up for some time; while in the other cases but few doses were given. Her methods, too, were more in accordance with the manner in which an animal on the range would become poisoned.

In 1882, 1883 and 1884 a fatal disease prevailed among the horses along the Missouri valley in Iowa, Nebraska and Dakota. Dr. M. Stalker, State Veterinarian of Iowa, discovered it to be due to *Crotalaria sagittalis.* The symptoms were similar to those produced

by the loco weeds, and upon looking for some plant allied to Astragalus or Oxytropis, he found the Crotalaria in great abundance. He had a large quantity of the green plant collected and tried to feed it to a young horse. The animal refused it, and finally he introduced a strong decoction into the stomach by means of a stomach pump. The horse exhibited all the symptoms of the poisoned animals, but recovered after a few hours. The next day he was given half as much as on the first day, and the animal died in an hour and a half. He procured another horse and gave it daily the infusion from a quart of the pods. The animal, after showing the characteristic symptoms, died on the thirteenth day.

Dr. F. B. Power and J. Cambier of the University of Wisconsin, made various chemical tests upon the Crotalaria and concluded that it contained a toxic alkaloid in small amounts. The Crotalaria caused great losses, amounting to thousands of dollars' worth of stock on some farms. The disease was marked by the emaciation so characteristic of the loco poisoning. Some animals became violently crazy, breaking through fences; but others exhibited stupor or coma, falling asleep while eating, and sometimes standing for a week sleeping most of the time with the head against some abject.

Of course, the subject of loco is more generally discussed in those states where stock-raising is one of the chief pursuits. Great losses have occurred in Colorado, particularly in the southern part. Mr. Ed. Farr, a prominent cattleman of Walsenburg, Huerfano county, Col., claims that, on an average, three hundred head of cattle are killed from loco in that county every year. Mr. E. C. Van Diest of San Luis, Costillo county, Col., writes as follows: "Fully twenty-five per cent. of the losses on cattle and horses in this section are due to loco weed. Its poisonous qualities seem to have the greatest effect from November to May. It is tempting to stock in the winter, when the grass is more or less covered with snow and its leaves surmount the snow; and also in the spring, when the grass is beginning to sprout and it is already of considerable size and conspicuous from its fresh verdure. The poison of the weed affects the nervous system, first clouding the brain and then paralyzing to a certain extent all muscular action until the animal finally dies in a state of stupor and seemingly of starvation. It begins by walking in a circle, which gradually narrows until the animal falls and expires. Though no well-fed animal will touch it, one that has happened

to eat the weed once or twice prefers it to grass, can no longer be fattened and becomes stupid and insensible to blows. Some victims indicate the spread of the disease by a sort of trembling, others become unmanageable and really crazy. The weed has no effect whatever on hogs; on sheep its effects are slight; horses seem most readily poisoned and cattle next."

The losses attributed to loco poisoning were so serious in Colorado that the legislature of 1881 passed a law to this effect: A premium of one and a half cents per pound was to be paid out of the state treasury on all loco or poison weed dug during the months of May, June and July. Each weed must be dug up not less than three inches below the surface of the ground and was to be thoroughly dry when weighed. The person who dug the weed was to produce it before the clerk of the county where it was obtained and swear that it was loco. The clerk was then to weigh the weed, burn it and give the owner a certificate setting forth in words the number of pounds of the weed, the name of the person, and that he had proved the digging up of the weed and was entitled to the premium. Upon presentation of this certificate to the county treasurer he was to be paid from the state treasury or he might pay his taxes in loco.

Considering the great number of species of Astragalus which abound in that region, so closely resembling each other that trained botanists find it difficult to surely and readily identify them, the impossibility of the ordinary county clerk accomplishing this task will be comprehended. He certainly could not examine every weed to see that the root was of the required length nor could he always be positive that every plant in the tons that were brought to him was the true loco or poison weed. How could he know when the plant was dry that it had been dug up only during the indicated months? Loco lands soon became very profitable, since a ton of loco was worth thirty dollars while the best upland hay brought only half that amount. Judging from the reports of expenditure on premiums, the supposed loco must have been brought in by the wagon load. The Mexicans were accused of planting it and caring for it assiduously. It would not be necessary to plant it, since if the roots were left in the ground, a new crop would at once begin to flourish; for loco is like alfalfa and comes up afresh whenever it is mown. Either in spite of the law or because of it the loco steadily increased

and soon threatened to bankrupt the state. Mr. Henry W. Selover of Denver, who carefully collected the facts concerning the law and its effects, gives the following table to show the result upon the revenue of the state:

Counties.	Gener'l Revenue from 1881 to '84, inclusive.	Loco Certificates issued '81 to '84, inclusive.	Amount short.
Chaffee	$24,632 73	$1,892 63	.....
Conejos	18,342 65	18 55	.....
Costillo	11,540 35	28,403 69	$16,863 34
Custer	16,758 98	21,017 44	4,258 46
Elbert	23,768 94	15 00	.....
El Paso	71,086 66	17,671 02	.....
Fremont	30,741 96	1,588 68	.....
Huerfano	16,946 08	41,748 89	24,802 81
Las Animas	41,344 37	14,063 12	.....
Park	24,989 92	1,595 42	.....
Pueblo	81,142 09	4,399 24	.....
Saguache	18,221 84	21,142 28	2,920 44
Total	$379,516 57	$153,555 96	

The law was luckily repealed in 1885, before it had swallowed the entire state revenue. The history of this legislation is a most notable instance of the inefficiency of bounty laws. The destruction of pests can and ought to be left to those most directly concerned. Indeed, to foster rather than destroy seems the general tendency of all bounty laws.

It seems strange, with agricultural experiment stations throughout the country, that the loco question does not become settled. Much of the confusion doubtless arises from the great similarity existing among the species of Astragalus and Oxytropis. The poison, too, may not be inherent in the plant, but due to a fungus or an insect. This view would perhaps explain its prevalence during some years and in certain regions and also the constantly increasing number of new loco weeds.

For much that this paper contains I am indebted to the Rocky Mountain Druggist, which republished the articles from which I have quoted.

SERENO WATSON.

Dr. Sereno Watson, after the death of Dr. Gray the foremost botanist of America, died at Cambridge, March 9, 1892, in the 66th year of age.

The many and important works which he has contributed to the knowledge of American Botany will form his best and most enduring monument.

RECENT LITERATURE.

Human Progress, Past and Future. By ALFRED RUSSEL WALLACE. Arena, January, 1892, pp. 145–159. An attempt is being made at the present day by the followers of Prof. Weismann to apply the Neo-Darwinian theories to all departments of scientific investigation. The natural impression has existed among many scientists that an acceptance of these views would lead to a very pessimistic outlook for man's future, but Mr. A. R. Wallace in the article under consideration takes the opposite stand. He points out the two significations of the term progress, which may mean either advance in material civilization, which he believes is cumulative and continuing at the present day, or advance in the mental and moral nature of man, which he thinks may be at a standstill. He contends, as many others have done, that the great works of antiquity have not been surpassed at the present day. Thus he says: "The earliest known architectural work, the great pyramid of Egypt, in the mathematical accuracy of its form and dimensions, in its precise orientation, and in the perfect workmanship shown by its internal structure, indicates an amount of astronomical, mathematical and mechanical knowledge, and an amount of experience and practical skill, which could only have been attained at that early period of man's history by the exertion of mental ability in no way inferior to that of our best modern engineers. In purely intellectual achievements the Vedas of ancient India, the Iliad of Homer, the Book of Job and the writings of Plato, will rank with the noblest works of modern authors." More than this, Mr. Wallace thinks that the high-water mark of intellectual activity has sunk rather than risen

during the past two centuries, although the mean level may have risen. He seems to look upon human progress as advancing along one direct line, and from this point of view it might indeed seem that the high-water mark had not advanced. There is, however, another aspect of the subject. It is customary to represent the progress of life by the analogy of a tree; why not, then, look upon human progress as taking place in the same manner? According to this view the civilizations of Egypt, of India and of Greece represent the terminal buds of their respective shoots. Modern civilization started afresh from the trunk of the tree, and may indeed not yet have grown much above the tips of the old growth of Egypt or Greece; yet there can be no doubt that the new growth is a larger limb and has infinitely greater prospects of future progress.

Mr. Wallace then proceeds to consider the factors which have been operative in the past and those which may be expected to exert an influence on the future advance or deterioration of mankind. He shows how the warfare of tribe with tribe has destroyed the weaker, while the greater vital energy of higher races frequently causes the extinction of the lower. Still more powerful than this warfare of one tribe with another is the survival of the fittest among the individuals of a single tribe. "On the whole," says the writer, "we cannot doubt that the prudent, the sober, the healthy and the virtuous live longer lives than the reckless, the drunkards, the unhealthy and the vicious; and also that the former, on the average, leave more descendants than the latter." He asserts that this process of elimination will raise the mean level, but very properly adds that "it can have little or no tendency to develop higher types in each successive age; and this agrees with the undoubted fact that the great men who appeared at the dawn of history and at the culminating epochs of the various ancient civilizations were not, on the whole, inferior to those of our own age." (p. 149.) This is, however, a very remarkable passage for Mr. Wallace to pen, for he has here virtually given up his customary Neo-Darwinian stand. If the process of natural selection or elimination cannot develop higher types of man by the selection and accumulation of already existing variations, how indeed can natural selection produce higher types of animals, as Mr. Wallace claims, by the selection of fortuitous variations? But he forsakes this position in another place. How, indeed, can the passage just quoted be made to harmonize with the

following: "When this average rise has been brought about there must result a corresponding rise in the high-water mark of humanity; in other words, the great men of that era will be as much above those of the last two thousand years as the average man will have risen above the average of that period. For those fortunate combinations of germs which, on the theory we are discussing, have brought into existence the great men of our day, will have a far higher average of material to work with, and we may reasonably expect the most distinguished among the poets and philosophers of the future will decidedly surpass the Homers and Shakespeares, the Newtons, the Gœthes and the Humboldts of our age." (p. 158.)

In no possible way can these two passages be reconciled. He first asserts that natural selection has raised the mean level of humanity but cannot raise the high-water mark, and follows this by another passage in which he says that the elevation of the mean level will furnish a higher class of material for germ combinations to work upon in the origination of a higher type of genius.

Mr. Wallace briefly discusses the theory of the isolation of the germ-plasm, which carries with it the non-inheritance of acquired characters. Education, according to this view, cannot have any direct effect upon human progress. The writer argues that if educational influences could be transmitted it would be reasonable to expect that there would be a progressive improvement in the families of men of genius from generation to generation. He cites a considerable number of notable instances where this was not the case, however. Thus he says: * * * "we find that Dollond, the inventor of the achromatic telescope, was a working silk weaver, and a wholly self-taught optician; Faraday was the son of a blacksmith, and apprenticed to a bookbinder at the age of thirteen; Sir Christopher Wren, the son of a clergyman and educated at Oxford, was a self-taught architect, yet he designed and executed St. Paul's Cathedral, which will certainly rank among the finest modern buildings of the world," etc. All of which may be perfectly true, but one is tempted to stop before completing the list and ask Mr. Wallace if he has forgotten the fact that all these men had mothers. Genius is a very unstable commodity and once the nice adjustment of mental traits by which it was brought about is disturbed by the introduction of a new element the whole organization is apt to be upset. Mr. Wallace might have continued with an enumeration of the sons of men of genius who have been worthless or insane.

The writer combats the view that the non-inheritance of educational culture is a bar to future progress. He goes even further and considers that it is a positive boon to humanity that such culture cannot be inherited. In order to do this he is obliged to take a most uncompromisingly pessimistic view of the present. "If it is thought," he says, "that this non-inheritance of the results of education and training is prejudicial to human progress, we must remember that, on the other hand, it also prevents the continuous degradation of humanity by the inheritance of those vicious practices and degrading habits which the deplorable conditions of our modern social system undoubtedly foster in the bulk of mankind. Throughout all trade and commerce lying and deceit abound to such an extent that it has come to be considered essential to success. No dealer ever tells the exact truth about the goods he advertises or offers for sale, and the grossly absurd misrepresentations of material and quality we everywhere meet with have, from their very commonness, ceased to shock us. Now, it is surely a great blessing if we can believe that this widespread system of fraud and falsehood does not produce any inherited deterioration in the next generation." There are many who would disagree with Mr. Wallace as to the universality of evil at the present day. Surely there is much less of evil now than in even comparatively recent past historical times. But even granting all that he requires of us, there must, according to his own views, be a time in the future when good will preponderate, at which time it will be as great a disadvantage that acquired virtue cannot be inherited as it now is an advantage that acquired vice cannot be. Yet another objection. According to the writer's views, the evil which he deplores in the present must be innate and due to the inherent properties of the germs, in which event it must be as easily transmitted, or indeed far more easily, than could an acquired character. This evil in man's nature which he sees may in fact be fostered by pernicious social institutions, but it must exist before it can be fostered, and if acquired characters cannot be inherited it must be inherent in the organism.

It may be of interest to inquire what Mr. Wallace considers to be the real factors of future progress. There are two such factors, he says. "The one is that process of elimination already referred to, by which vice, violence and recklessness so often bring about the early destruction of those addicted to them. The other, and by far

the more important for the future, is that mode of selection which will inevitably come into action through the ever-increasing freedom, joined with the higher education of woman." This second must indeed be a factor of great importance, it would seem, although by no means the only one. Selection of the best existing cannot alone produce anything better than the best. C. A. K.

The Auk for January, 1892, contains nothing of special interest to the Pacific Coast. The supplement containing the address by the president, Mr. D. G. Elliot, on The Inheritance of Acquired Characters, is a timely and interesting discussion of this vital problem in biology, and deserves a careful reading. The closing words of the address are especially worthy of consideration by our American ornithologists. "The subject I have discussed offers a new field for ornithologists to explore: one of a higher plane, and permitting a wider vision than many of those they are accustomed to tread. I submit it to my younger colleagues, who have time and opportunities before them, as of infinitely more importance than the discovery and naming of new forms, which is by no means the beginning and end of ornithology, but rather, if I may so term it, the A B C of the science; and then, by their contributions towards the elucidation of my theme, they will benefit not only those who are devoted to our own branch, but also scientific men throughout the world." His arguments would have had more weight if they had not been stated from so obviously a partisan standpoint. Some of the instances which he gives in proof of the inheritance of acquired characters may be equally well explained in other ways, and hence are not conclusive. C. A. K.

A Preliminary Study of the Grackles of the Subgenus Quiscalus. By FRANK M. CHAPMAN. Bull. Am. Mus. Nat. Hist., iv, 1–20. The subgenus Quiscalus has always been known as a puzzling group of birds, but the real complexity of the inter-relationship of the different forms was probably not fully realized before the appearance of Mr. Chapman's comprehensive review. Although 845 specimens were examined, this material was found insufficient to complete the study of the group. Certain questions of vital importance are, however, apparently settled. The three forms, *Quiscalus æneus*, *Q. quiscula*, and *Q. quiscula aglæus*, are carefully described, and in a summary a brief diagnosis of each form is given, including

each of the three phases of *quiscula*. The variations of each form are then carefully followed throughout their breeding range, and the general conclusions as to relationship stated. The two most important conclusions are that—"In the Alleghanies of Pennsylvania, in the Hudson Valley from Sing Sing to Troy, in eastern Long Island, in Connecticut, and in Massachusetts as far north as Cambridge, *quiscula* and *æneus* completely intergrade"; and that—"This intergradation is in every instance accomplished through phase No. 3 of *quiscula*."

Mr. Chapman then argues very reasonably that *quiscula* is a distinct species, and not a race of *æneus*. If this be not the case, he asks why *æneus* should remain so perfectly constant over an immense area and then change into three different forms. It is, at least, impossible to see any environmental influence which could have produced such a modification as this, and the matter accordingly becomes inexplicable upon any theory except hybridity.

Although Mr. Chapman has established by his careful investigation at least the great probability that hybridization is the rule among the grackles, he is hardly justified in extending this to other species. Thus he says: "Nor do I see any good reason why we should refuse to admit hybridization as a factor in the evolution of what we term species. * * * Difference in habit under what must necessarily be similar conditions will ever be an effectual barrier against the indiscriminate mixing of even closely-allied birds. But when two species whose natural economy, song, nidification, etc., are the same, and which agree in structural details and differ only in coloration, inhabit contiguous regions, is it unnatural that they should at first occasionally, and in the end regularly, interbreed? The evidence in proof of such intergradation is gradually accumulating, and in the future I think we shall be forced to recognize hybridization, not only as a means which unites known forms, but which also gives rise to new ones."

The writer has apparently overlooked, in the above passage, the possibility of physiological selection interposing a barrier to hybridization, even when the two species appear to be structurally identical. If the theory of physiological selection is to have any validity whatsoever, it is necessary to assume that such cases of habitual hybridization as are occasionally recorded, are exceptional and abnormal. To be sure, it may be objected that this is arguing from

theory to fact, but then a good and useful theory should not be too lightly discarded.

C. A. K.

The North American Species of the Genus Colaptes, considered with Special Reference to the Relationships of C. auratus and C. cafer. By J. A. ALLEN. Bull. Am. Mus. Nat. Hist., iv, 21–44. In the present paper Mr. Allen has undertaken a most careful and thorough investigation of the remarkable intergradation existing between *Colaptes auratus* and *C. cafer*. His report is based upon the examination of 785 specimens of the genus from North America and the West Indies, representing all the known species and varieties inhabiting this region. The relationship of the two species under consideration is first discussed, and the characteristics and distribution of the various races given. More detailed attention is then devoted to the intermediate birds, the conclusions arrived at with regard to them being stated as follows: "The facts elicited in the present investigation tend strongly to confirm Baird's startling hypothesis of hybridization on a grand scale between *Colaptes auratus* and *C. cafer*, to account for the occurrence of birds presenting ever-varying combinations of the characters of the two species over the Plateau and Great Basin regions of the continent. None of the other hypotheses thus far advanced so fully, or, in fact, to any great extent, meet with the requirements of the case. In no instance do we meet with stages or methods of geographical variation at all comparable with what is seen in the case of *C. auratus* and *C. cafer*. The transition between geographic forms, however diverse, is gradual and symmetrical, affecting all parts of the plumage equally and simultaneously, and is obviously correlated with changes in the physical surroundings; also, the differences between the most extreme forms are merely differences of degree. In the case of Colaptes, the essential differences between *auratus* and *cafer* are radical; they are, in fact, contrasting characters, and the intergradation is irregular, with all sorts of a symmetrical combinations of the characters of the two forms, and no correlation between their intergradation and the conditions of environment."

Mr. Allen has, in fact, practically demonstrated the habitual hybridization of these two species, as Mr. Chapman has just succeeded in doing for the grackles. The bearing of this demonstration upon the infertility of crosses and the relation of color to sterility, as discussed by Wallace in "Darwinism," is very important, placing the

subject in a somewhat new light. The facts do not seem to bear out Mr. Chapman's suggestion, however, that hybridization may be a means of originating new species, for, in the present instance, the tendency seems to be rather to merge two existing species into one.

C. A. K.

The Geographic Distribution of Life in North America, with special reference to the Mammalia. By C. HART MERRIAM, M. D. Proc. Biol. Soc. Washington, vol. VII, pp. 1–64. Fauna No. 3 of the Department of Agriculture was an epoch-making work in the literature of the geographical distribution of animals in America. Dr. Merriam, in the present work, has amplified and systematised the ideas which were there first enunciated. With the unequalled facilities at his command in the shape of probably the largest and most discriminatingly collected series of mammals that has ever been made from the same extent of territory, he is in a better position than any of his predecessors to draw conclusions with regard to the distribution of life in North America.

The paper commences with a historical synopsis of the faunal and floral divisions proposed for North America by various writers. Each division is considered separately, with a chronological table of the work of different writers upon it. The different life regions are then discussed with reference to the mammals inhabiting each. Considerable space is devoted to the causes controlling distribution and in combating certain of Wallace's views. Dr. Merriam is especially pronounced in asserting the importance of temperature in directly affecting the distribution of animals, and his answer to Wallace with regard to the change in mammalian forms from the north southward is very forcibly put. The general drift of his paper is, that life zones are largely climatic, and consequently extend in belts more or less parallel to the equator rather than in a north and south direction, as claimed by Wallace.

In closing, he says: "Wallace, in writing of the principles on which zoological regions should be formed, expresses the opinion that 'convenience, intelligibility and custom should largely guide us.' But I quite agree with America's most distinguished and philosophic writer on distribution, Dr. J. A. Allen, that in marking off the life regions and subregions of the earth, truth should not be sacrificed to convenience; and I see no reason why a homogeneous circumpolar fauna of great geographic extent should be split up into primary re-

gions possessing comparatively few peculiar types, simply because a water separation happens to exist in the present geologic period; nor is it evident why one of the resulting feeble divisions should be granted higher rank than a region of much less geographic extent comprising several times as many types." C. A. K.

Wood Notes Wild. Notations of Bird Music, by SIMEON PEASE CHENEY. Collected and arranged with appendix, notes, bibliography, and general index, by JOHN VANCE CHENEY. It has been the fashion of scientific ornithologists to pass over the songs of birds as something unworthy of their serious attention, contenting themselves with occasional vague phrases descriptive of bird notes introduced in their lighter writings. The cause of this is not that bird songs are of no scientific importance, but that it is almost impossible to record them in a manner sufficiently accurate to reduce their study to a science. There is no reason why the phonograph might not be brought into use for this purpose; but in the absence of any such investigations as this, the work of Mr. Cheney cannot fail to prove a great benefit to this much neglected corner of science. It remains for future investigators to verify the accuracy of his musical notations; but in view of the fact that he was primarily a musician, and at the same time an accurate and painstaking observer and an enthusiastic admirer of birds, there is every probability that his interpretations are in the main correct.

As a foundation for the future study of bird notes, the value of this work cannot be overestimated. The typical songs and many of the variations and call notes of all the more common Eastern birds are recorded in musical scale with text descriptions and amplifications.

Much of this music has been published in the magazines, but Mr. John Vance Cheney has done more than make a collection of his father's work in the present work. Over half the book is devoted to an appendix, in which are incorporated all the most important descriptions and notations of bird music which have been published by other writers, with much other matter bearing more or less directly on the question under consideration. A very full bibliography of the subject closes the work. C. A. K.

The American Naturalist. October, 1891.—Notes on the Hearts of Certain Mammals: By Ida H. Hyde. Brief notes on points of

interest regarding the hearts of sheep, cat, man, monkey, panther, raccoon, hyena, dog, deer, calf, horse, donkey and rabbit.

November, 1891.—Language and Max Müller: S. V. Clevenger, M. D. A criticism of Müller's attitude with regard to the evolution of language. The writer says: "Throughout Max Müller's writings he is handicapped by his exaggeration of the importance of his particular line of research, carried on as an isolated study. Could he but have a fair knowledge of associated sciences, such as that of anthropology, anatomy, physiology and zoology, the value of his work would be greatly increased, and his inferences would undergo radical changes." On the Quantity and Dynamics of Animal Tissues: J. Lawton Williams. Recent Progress in the Discovery of the Phylogeny of Man: Editorial. The discovery of skulls verifying the supposition that a race of people inhabited Europe with skulls similar to that of the Neanderthal man, is noted. Also, of two nearly complete skeletons, of which they say: "Taking it altogether, the Canstatter race answers the expectations founded on theory as to what an ancestral type of man ought to be." Professor Cope also finds confirmation for his theory that the anthropoid apes and man were descended from the anthropoid lemur Anaptomorphus, without passing the intervention of the old world monkeys.

C. A. K.

The Ibis, for January, 1892, contains among articles of general ornithological interest, a list of the birds of Heligoland as recorded by Herr Gätke, by Henry Seebohm; Some further Notes on the Periods occupied by Birds in the Incubation of their Eggs, by William Evans, F. R. S. E.; and the fourth part of the Rev. James Sibree, Jr.'s, paper, On the Birds of Madagascar and their Connection with Native Folk-lore, Proverbs and Superstitions. C. A. K.

HARALD SCHÖTT, of the University of Upsala, Sweden, has published: *Beiträge zur Kenntniss Kalifornischer Collembola*, mit 4 tafeln in Bihang Till K. Svenska Vet.-Akad. Handl. Bd. 17, Afd. iv, No. 8.

Collembola are minute Thysanuræ, or wingless insects, which live under leaves and stones, and propel themselves by jumping. The work is a very interesting one, as very little is known about these small animals in any part of the world. The material was collected in California by Dr. Gustav Eisen, and forwarded to the author for

description. The following species are described, five of which are new: *Sminthurus Eisenii*, n. sp.; *S. luteus Lubbock; S. niger Lubbock; S. plicatus*, n. sp.; *Papirius maculosus*, n. sp.; *Tomocerus* sp.: *Entomobrya nivalis* L.; *E. multifasciata* Tullb.; *E. marginata* Tullb.; *Sira purpurea*, n. sp.; *Drepanura californica*, n. sp.; *Orchesella rufescens* Lubbock; *Isotoma viridis* Bourl; *I. palustris* Müller; *Achorutes armatus* (Nicolet); *A. viaticus* Tullb.; *Xenylla maritima* Tullb.; *Lipura inermis* Tullb.; or, in all, about 18 species. The paper is handsomely illustrated. G. E.

Revisio generum plantarum vascularium omnium, atque cellularium, multarum, secundum leges nomenclaturæ internationales, cum enumeratione plantarum in itinere mundi collectarum. Mit Erlauterungen von Dr. Otto Kuntze.

This book is likely to serve a most useful purpose—it shows to what extent zeal without discretion may carry a reformer, and incidentally may make clear to a few American botanists, ardent makers of synonyms, their inability to cope in such matters with those who are able at any time to consult the great libraries of Europe.

Dr. Kuntze, in his journey round the world, collected a few thousand species, and in working them out to his satisfaction, changes about thirty thousand names. The means by which he arrives at this result is the rather radical one of taking for his point of departure an earlier work of Linnæus than the one generally adopted.

Another method of changing genera which he uses with considerable effect is the substitution of older sectional, for more recent generic names. This though the logical outcome of the practice of some American botanists in the matter of varietal names is as repugnant to common sense as a claim of priority founded on the distribution of named sets.

The license, which the author allows himself, of modifying (correcting as he terms it) generic names, is not likely to meet with acceptance. The principle of priority will appear to most persons to be as absolutely overthrown by substituting Cumaruna, Catutsjeron, etc., for Coumarouna, Katoutsjeroe, etc., as by making entirely new names. The principle is the same, the violation differs only in degree, and the inconvenience resulting from the alterations in indexing is the same.

A considerable number of his generic changes will probably be concurred in, though not in the scrambling manner in which they

are launched by the author; but his wholesale transference of the species of a thousand genera, many of them of great extent, can only be considered an instance of colossal vanity, which will go far to convince botanists of the value of the zoological rule. It is impossible to assign any other reason than the gratification of personal vanity to the author's addition of "OK." to all the species of such genera as Astragalus, Selaginella, Lepiota, Corticium, etc., the value of which species he could not possibly know. It is an amusing circumstance that in America the abbreviation with which his pages is so plentifully besprinkled is a slang expression in common use, said to have had its origin in indorsements on papers submitted to an eminent politician, who was as lawless in orthography as our author has proved himself in botany. When questioned as to its meaning, he explained that it meant "Oll Korect."

It is to be hoped that in giving new names to his genera he did not act from a malicious desire to render the recipients of his favor ridiculous. Such names as "Bakeropteris," "Bisbœckelera," "Biscogniauxia," "Brittonamra," "Cookeina." "Durandeeldea," "Greeneina," "Henribaillonia," "Jacksonago," "Jamesbrittenia," "Peckifungus," "Radlkoferotoma," "Sirhookera," "Sirmuellera," "Smithiantha," may look well to his eyes and sound agreeably in his ears, but his taste is likely to be unique.

Among the numerous changes which, if adopted, would affect our Californian plants, may be mentioned Buda, which the author adopts instead of Tissa, because the latter remained longer a "nomen nudum;" but with a degree of inconsistency for which one would have hardly looked, he shortly after adopts Meadia instead of Dodecatheon, transferring all the "species" (of whose value he is necessarily absolutely ignorant) to a genus which remained "naked" till his day—that he might attach "OK." to the species.

Agoseris, which he accepts in place of Troximon, is in similar case according to Mr. Greene the devoted disciple of Rafinesque, for all the species are claimed by Mr. Greene in "Pittonia," which of course he could not do if there were a type species. Dr. Kuntze nevertheless, having apparently kept the scope and intention of his work entirely secret, renames the species under the same date as Mr. Greene, but of course attaches "OK." to all of them. A similar muddle results from the equally inexcusable renaming of Leguminous species by Dr. Taubert in Bot. Centralblatt. September, 1881.

We have therefore in these cases and probably many others, two sets of synonyms, the priority of which will be extremely difficult to prove should it ever be necessary to do so.

Navarretia, which has priority over Gilia, has also the refreshing novelty of a type species; for the number of genera in which all the species are credited to "OK." becomes monotonous. As to the changes involved by calling Lepidium, Nasturtium; Ionidium, Calceolaria; Gouania, Lupulus; Phlox, Armeria; Cortinarius, Gomphus; etc., we fear the author's life will not be long enough to see them made.

The changes in nomenclature are not confined to phanerogamic botany, but cover the whole range of the vegetable kingdom, and wholesale changes are made quite as coolly in fungi, the genera of which are notoriously in a transition state, as in the more settled orders. It is to be feared that Cryptogamic botanists will consider the author guilty not only of folly but of impertinence as well.

As the author has done little in studying the values of genera, the changes in specific names are comparatively few. He shows a tendency to reduce genera, and though there is a sufficient field for the exercise of such a spirit, it may be doubted whether he has selected the most promising examples.

He argues at length and with considerable feeling against the changing of specific names, and most botanists will agree with him; but he might have gone much further and shown how improper and unnecessary it is to change them at all, except in monographs of families—else why the third name attached to species? In the work of botanists who accept the zoological rule, and they are numerous and increasing, the cited name furnishes a means of distinguishing the species until the monographer can deal with them. Mr. Hemsley, for instance, in listing the Mexican species of Dalea,* evidently recognizing the fact that he was unable to judge of the validity of the species with the material at hand enumerates—

20. *Dalea elata* Hook. & Arn.

21. *Dalea elata* Mart. & Gal.,

and the future monographer of the Leguminosæ will be able to distinguish them and decide on their merits just as well as if one of them had been afflicted with the name *galeottiamra*.

* Biol. Cent.-Am. i, 239.

The sooner any botanist of our day divests himself of the idea that he is likely to live to see a settled nomenclature, or that the rest of the botanical world will allow some fifth-rate authority to attach his name to the work of all the great men who have preceded him, the sooner we shall be able to argue out generic questions without lugging all the species in by the ears, and so adding immensely to our synonymy.

The reason for such extensive changes without study of the species, can only be the belief of an author that his judgment will finally settle the nomenclature, and the fact that these wholesale transferences are made almost entirely by those who attach the last combiner's name furnishes the strongest proof of the motive. Whatever fault may be found with Bentham and Hooker for their work in "Genera Plantarum" they must be commended for their modesty, for on the line followed out by Dr. Kuntze they might have attached B. & H. to an immense number of species, with no greater trouble than that involved in the employment of an additional copyist.

It should not be forgotten by botanists in haste to settle nomenclature, that there are two questions hanging over systematic biology of such importance as to cast Dr. Kuntze's modest contribution to synonymy entirely into shade. The first of these is homonymy as between zoology and botany, a question which can only be settled by agreement between the great body of zoologists and botanists. The second, the limits of genera, we may all help to solve. About species there is often a considerable divergence of honest opinion, which time and better knowledge will be apt to reconcile, but genera should be more easily settled. It ought to be possible to make to some extent rules as to what should and what should not be taken into consideration, especially as long as genera are to a great extent matters of convenience. Undoubtedly the tendency is to make them more strictly natural, and great modifications are likely to result particularly in such families as Compositæ, Caryophyllaceæ, Acanthaceæ, etc., in which they are now extremely artificial. A little logic injected into systematic botany might enable us, for instance, to see that if its various sections can be properly included in the genus Quercus, there can be no sufficient reason for holding Castanopsis distinct from Castanea or Carya from Juglans. The theory that the limits of genera and

species can best be determined by a kind of individual "insight" without any rule whatever, has had a long trial and the heterogeneous results are hardly encouraging. [K. B.

Monograph of the Grasses of the United States and British America. By DR. GEORGE VASEY, Botanist, Department of Agriculture. Pamphlet, 8vo pp. vi, 89, xiv.—This is No. 1, of vol. iii, of the "Contributions from the U. S. National Herbarium," and is "published by the authority of the Secretary of Agriculture." This part closes with the family Agrostideæ.

The author states that for several years he has had in contemplation the work here presented. Every one knows of the great wealth of material—necessary for the preparation of such a work—contained in the National Herbarium. Collections of grasses from all parts of North America have been coming to this herbarium for a long time past, and these additions have been especially frequent in recent years. Liberally supplied with books and assistants, and otherwise very generously supported by our National Government, the Botanist of the Department has had unrivalled facilities for the production of the present "Monograph."

The work before us comes far from meeting our expectations. It is entirely lacking in that clear, precise and systematic presentation of facts which stamp the work of the true scientist; and instead of being a "Monograph," it is very largely a compilation—a bringing together of scattered descriptions, some of which are quoted and duly credited, some quoted "with a little alteration" (mangled, would better express it), and some quoted without any recognition of the source whatever; and these last form no inconsiderable portion of the whole. This frequent quotation of descriptions published by various authors renders the whole thing incongruous, not only in the relative length and character of the descriptions given, but in the terminology. If the original descriptions of the species had been copied instead of those published by later authors, and a proper system of references adopted, the value of the work would have been increased.

Setaria viridis and *S. glauca*, on p. 38 of the "Monograph," do not appear to possess very marked distinguishing characters.

Stipa Stillmani, on p. 51, is rendered as follows: "*S. Stillmani* Bolander. (Bot. Cal. ii. p. 287)." Then follows Dr. Thurber's description of this species, word for word, excepting that the floret is

said to possess a "white, hairy callus," instead of a "white-hairy callus," as Thurber wrote it, and there is nothing to indicate that it is not all original. One would naturally infer from the above, however, that Bolander published this grass in the Botany of California, which was in fact not the case.

The description of *Stipa leucotricha*, on p. 53, is but a translation of that given by Trinius and Ruprecht in their joint work usually cited "Stipaceæ," not "Gram. Agrost.," as appears in the work before us.

On p. 55 *Stipa Richardsonii* Link is described and there is given the reference in parenthesis, "(Gray's Manual, 6th ed., p. 641)." This amounts to a statement by the author that he is describing the same plant as that described by Gray in the 6th ed. of the Manual, but he states below that his description applies to the "large form which Prof. Macoun called var. *major*, and is perhaps specifically distinct from the form which is found on Lake Superior" (where on the lake is not specified) "and eastward." We all know that it is this eastern form which is "perhaps specifically distinct" from the other, that is described in the Manual.

Did Smith describe *Polypogon littoralis* in the Botany of California? We might very justly presume so from the way the name and description stand on p. 57. And why is it that quotation marks enclose the descriptions of *Polypogon Monspeliensis* and *P. littoralis*, and not that of *P. maritimus?* Is it because there were no specimens of these plants in the National Herbarium that the monographic character of the work was thus marred by scissors and paste? The descriptions of *Sporobolus compressus* and *S. serotinus* are taken entire from Gray's Manual, and one might be led into the error that the last named species was first described by Gray in the 6th edition of the Manual.

On p. 80, there seems to be some confusion as to *Calamagrostis dubia*. It is described as a species, and also presented as a var. of *C. Canadensis*.

There is nothing in the descriptions indicating the differential characters of allied species, and rarely are there any comparisons drawn. Carefully describing one organ or a part in one species and saying nothing about this in the next in sequence is far too common a feature in existing descriptions of our plants, and leads the student into a world of tribulation. A close attention to this point

in the preparation of monographs would, we think, somewhat reduce the number of our species, especially in Gramineæ. In this connection we might call to notice the descriptions of *Alopecurus Howellii* and *Alopecurus Macounii*, in the present work (pp. 87 and 88).

The assistance afforded by the translation of "The True Grasses" in the preparation of the analytical tables is acknowledged in the Introduction, and thanks are returned to Prof. Hackel for the privilege of using this work, although the translation is an American production and copyrighted by the publishers.

There are a number of "slips" which might trouble or confuse the student. We are told on the first page that the floral organs, the palet, the lodicules and the floral glume, "constitute a spikelet." Only the first glume in the Andropogoneæ is said to be "more indurated than the inner ones." Over Oryza, on p. 4, the empty glumes are described as "awnless, the flowering glume and palet much compressed laterally." These characters are supposed to enable us to distinguish Oryza from Leersia, which follows, and which has "flowering glumes awnless;" we are not told whether the glumes are compressed or not. In the tribe Oryzeæ, the empty glumes are said to be "two or none, very seldom numerous." Hackel says "empty glume two or more, very seldom numerous." In most of our species of this tribe the empty glumes are wanting. The grain in Sporobolus (p. 5) is characterized as "loosely enclosed or naked." On the same page the flowers of Epicampes are said to be "large" and "not awned."

In this first part some twenty species are described for the first time, and a few of these are characterized as new.

We hope that greater care will be exercised in the preparation of the second part, which the author hopes to publish "within a few months." In the Introduction, criticisms are invited, and we only regret that a work so excellent in its object should be so open to criticism. If through what has here been said, the character of part 2 reaches a higher plane, we shall only be too glad to publish the fact.

F. LAMSON SCRIBNER.

Fossil Botany: Being an Introduction to Palæophytology from the Standpoint of the Botanist. By H. GRAF ZU SOLMS-LAUBACH, Professor of Botany in the University of Strasburg. *Authorized English Translation.* By HENRY E. F. GARNSEY, M. A. Among re-

cent botanical works it would be hard to find one which is more welcome to the student than the one before us. The original was published in Germany, in 1887; and now we have an admirable English translation issuing from the Clarendon press, to which we owe so many excellent translations of standard German botanical works.

The literature of palæophytology is so scattered as to be practically inaccessible to the general botanist; and, moreover, a great part of it is the work of men who are not botanists at all, the result of whose works is an appalling mass of fragmentary and often utterly unreliable material. Count Solms not only has won a high reputation as a palæophytologist but has also done excellent work in other departments of botany, and, as a thoroughly trained botanist, is eminently fitted for the task he has so admirably performed in the volume before us. To him we owe a careful resumé of what has been done up to the time of publication of his book, and a thorough sifting of the material thus brought together. He is extremely cautious in his judgments, and often suspends judgment entirely; but where he makes a positive statement one is sure that it is based upon adequate evidence. As the result of this careful examination, many forms, usually accepted by palæophytologists, are thrown aside as resting upon imperfect evidence, and, in consequence, one's ideas of the nature of many of the fossil forms are materially changed.

An introduction of some thirty pages deals largely with the conditions under which plant remains have been preserved in a fossil state, and includes an able discussion of the formation of peat and coal beds. The Thallophytes and Bryophytes are disposed of in a single chapter, and the rest of the book is devoted to a consideration of the lower vascular plants — Pteridophytes and Gymnosperms. The Coniferæ are treated first for reasons thus given by the author: "In departing from the customary arrangement * * * we have been influenced chiefly by practical considerations, for the adoption of this order will facilitate the discussion of the many doubtful forms which belong to one or the other of these classes, but which it will be best to consider in connection with similar groups of the Archegoniatæ." A chapter is devoted to the group, and the author seems to think that there is not sufficient evidence to warrant the assumption that conifers of the modern types existed

anterior to the Mesozoic. The remains occurring in older formations, and usually attributed to this class, are either too imperfect to permit of certain classification, or may better be referred to other groups. Of living genera Araucaria is certainly known as far back as the Jurassic, and Sequoia as the Cretaceous; Ginkgo is still older.

A special chapter is devoted to the Cycads and Medullosæ, and another to the remarkable entirely extinct group of the Cordaiteæ. To the latter, which are separated entirely from the Coniferæ, are referred many of the remains of fossil wood which have usually been supposed to belong to the Coniferæ. The most interesting point in connection with them is the discovery of flowers, both male and female, in a sufficiently perfect state of preservation to give a very fair idea of their structure, which differed materially from that of any living gymnosperms. The pollen grains are preserved with remarkable perfectness, even showing a group of cells within which is assumed to be a sort of rudimentary prothallium like that in the pollen of other gymnosperms, but much more highly developed. These points seem to warrant the separation of the Cordaiteæ as a class, co-ordinate with the Cycads and Conifers.

The chapter on the ferns is especially interesting and suggestive. While a considerable number of ferns have been found with well preserved fructification, all of these in the formations below the Mesozoic, that can be positively determined, show affinities with the Marattiaceæ and, perhaps, with the Ophioglosseæ. This fact is especially significant, as it entirely reverses the ordinarily accepted arrangement of the leptosporangiate and eusporangiate ferns. The former—*i. e.*, those ferns in which the sporangia are of strictly epidermal origin—are usually regarded as the simpler forms from which the Eusporangiatæ, or those forms with massive sporangia, like the Marattiaceæ and Ophioglosseæ, have been derived.

As the Leptosporangiatæ have firm sporangia that ought to have been preserved in a fossil state, it is difficult to account for their absence from the coal measures and earlier formations, if they really existed when these were forming. It seems probable that they are really later, more specialized forms, derived secondarily from the more primitive Eusporangiatæ. This view accords, too, with the evidences of embryology, and simplifies very much the problem of the origin of the phanerogams. The remains of hydropterides are very scanty, and only a few remains from the tertiary are beyond dispute.

Lack of space forbids our dwelling upon the very full account of the characteristic groups of the Calamarieæ, Lepidodendroideæ, Sigillarieæ and Sphenophylleæ. The first, which are usually supposed to show unquestionably near relationship to Equisetum, are shown to be much more imperfectly understood than was supposed, but for the details of the discussion the reader must be referred to the work in question. It is rather unfortunate that the angiosperms are not treated, as it would be extremely interesting to hear the author's views upon the origin of the group, as well as to have the data upon which to work for one's self.

The translation of the book and the typography are alike admirable, but it is a pity that it was not revised up to date, as several important works have appeared since the original was written. By a curious oversight this lack of revision was carried even to the title-page, where we are informed that the author is professor at Göttingen, although he succeeded De Bary at Strasburg more than three years ago.

D. H. C.

Outlines of Lessons in Botany for the use of Teachers, and Mothers Studying with their Children. By JANE H. NEWELL. Part II. Flower and Fruit. The author of this little volume is an enthusiastic teacher, imbued with the spirit of modern science. The children are to study the plants themselves, so as to become original observers and thinkers instead of the "intellectual parasites" that so generally disgrace our schools. They are to be led to draw the parts of the flower, etc., united and separated, and in different sections. The correct botanical terms are to be learned as the necessity arises for their use. One of the most valuable features of the work consists of numerous suggestions for investigation into the habits of plants, particularly concerning the fertilization of flowers. Even quite little children may discover treasures of knowledge in this almost unexplored field. The study will become interesting and inspiring with such an incentive to patient, careful observation.

That the plants studied are chiefly those of New England, would make no difference to anyone but a rote teacher. It is the method illustrated by these studies that gives the book its great value as an aid to the teacher who is striving for the true education of pupils.

A. E.

The Identity of Asclepias stenophylla and Acerates auriculata. JOHN M. HOLZINGER. Bot. Gaz., Apr., 124. Mr. Holzinger having made careful study of the various forms of those plants, considers them mere variations of the same species, and unites them under the oldest available specific name, *Asclepias auriculata* (Engelm.). Studies of this kind are of much more importance than dozens of barely distinguishable "new species." K. B.

PROCEEDINGS OF SOCIETIES.

CALIFORNIA ACADEMY OF SCIENCES. *February 1, 1892.* President Harkness in the chair.

The Librarian reported 153 additions to the library.

Charles A. Keeler read a paper on "Heredity in its Relation to the Inheritance of Acquired Characters."

February 15, 1892. President Harkness in the chair.

Donations to the museum were reported from Charles A. Keeler, H. Abbott, Herbert Brown, E. D. Flint, Miss Louise A. Littleton, Geo. B. Badger, Charles N. Comstock, Charles Hubbard, T. B. Sanders, George W. Dunn, William G. Blunt, Walter E. Bryant.

The Librarian reported 160 additions to the library.

Dr. Gustav Eisen read a paper entitled: "The Evolution of the Forms of Trees as Produced by Climatic Influences."

March 7, 1892. President Harkness in the chair.

Donations to the museum were reported from W. S. Bliss, Gustav Eisen, T. B. Sanders.

Letters were read announcing the donation to the herbarium of a collection of Greenland plants by John H. Redfield, and of a package of specimens of Sphagna of the northeastern United States, by Edwin Faxon, and a vote of thanks was tendered to each of those gentlemen.

Charles A. Keeler read a paper entitled: "Is Natural Selection Creative?"

Dr. Harkness exhibited specimens of the Cynips which is now so abundant in Golden Gate Park, also of the galls from which they are emerging, and made some remarks on their life-history.

April 4, 1892. President Harkness in the chair.

The President announced the death of Sereno Watson, honorary member, and of William A. Aldrich, resident member.

The Librarian reported 222 additions to the library.

Dr. Harkness made some remarks concerning his observation on the life-history of the Cynips infesting the oaks, and discussed the probability of the one attacking the buds being an alternate generation of the one forming the woody galls.

F. Gutzkow spoke on certain improvements in his process for parting silver bullion, which he explained to the Academy about a year ago. He stated that it has now been introduced successfully into practice, for instance, at the large refining works of the Consolidated Kansas City Smelting Company. Among the novel modifications of the process the most important is the melting of the crystals of pure sulphate of silver, which are separated in the course of the process with five per cent. of charcoal in the crucible. They are thereby, at a very low temperature, converted into metallic silver, which melts and is poured into bars. Carbonic and sulphurous gases are generated and escape without giving any inconvenience:

$$Ag_2\,SO_4 + C = Ag_2 + CO_2 + SO_2$$

Charles A. Keeler made a few remarks bearing on the question: "What constitutes a species?"

April 18, 1892. President Harkness in the chair.

Miss Alice Eastwood and William L. Watts were elected resident members.

The following communication was read:

SAN FRANCISCO, April 18, 1892.

Secretary, California Academy of Sciences:

DEAR SIR—The proprietors of Zoe have the honor to offer for acceptance of the Academy 50 copies each of volumes I and II of that journal, to be distributed to the principal societies of the world which are in correspondence with the Academy, in grateful acknowledgment of favors granted to the California Zoological Club and the California Botanical Club.

Respectfully,

H. W. HARKNESS,
T. S. BRANDEGEE,
KATHARINE BRANDEGEE.

The President then introduced Mr. Edward Muybridge, who delivered a lecture on "The Science of Animal Locomotion," with lantern illustration of consecutive phases of animal movements and syntethical reproductions by the zoopraxiscope.

CALIFORNIA BOTANICAL CLUB. *February 25, 1892.* The Vice-President, Mrs. M. W. Kincaid, in the chair.

Brofessor Douglas H. Campbell delivered a lecture on the Origin of Flowering Plants. The lecturer stated that the ancestral forms of all the higher plants are to be sought among the fresh-water algæ. From these were probably developed forms like the simplest of the existing liverworts, and from these the higher forms, Bryophytes, Pteridophytes and Spermaphytes were later derived.

The structure of the simpler liverworts was briefly sketched and the development and fertilization of the archegonium and the subsequent development of the sporogonium described. Attention was called to the motile spermatozoids, and the necessity of water in fertilization, as indications of the aquatic nature of the ancestors of these forms.

Special attention was called to Riccia and Anthoceros as the most primitive in some respects of the liverworts, and the latter was especially spoken of as representing a form like that from which the higher plants have probably come.

The forms were next taken up, and after showing how the prothallium represents the liverwort thallus, and the fern itself the sporogonium, attention was called to the gradual reduction of the sexual prothallium and the increasing development of the sporophyte in the higher forms. It was then shown how this was accompanied by the development of heterospery in several groups, resulting finally in one case, at least, in the production of seed-bearing plants.

Flowers are only groups of special spore-producing leaves, with more or less accessory leaves in the more specialized ones. The simpler flowers are comparable to the spore-bearing leaves of an Osmunda, for example, or a spike of Equisetum. In the heterosperous Pteridophytes spores of two kinds were developed, and these in the flowering plants are the pollen-spores and the embryo-sac. The ovule and anther are simply special forms of sporangia.

In conclusion the influence of two groups of animals—viz., birds and insects—upon the further evolution of flowering plants were

spoken of. These have played an important part in the evolution of these forms as the development of edible fruits and brilliant flowers has undoubtedly been brought about mainly through their agency. As soon as the distribution of seeds and the pollination of flowers became dependent upon these, sharp competition was set up to attract these visitors, and the result we see in the amazing variety of forms now upon the earth.

March 5, 1892. Annual Meeting. The Vice-President, Mrs. M. W. Kincaid, in the chair.

The annual reports of the Secretary and Treasurer were read and ordered filed.

The following officers were elected for the ensuing year:

President—Douglas H. Campbell.
Vice-President—Mrs. S. W. Dennis.
Secretary—Frank H. Vaslit.
Treasurer—Miss A. M. Manning.
Librarian—Mrs. S. W. Burtchaell.
Curator—Miss Edith B. Falkenau.
Councilors—Mrs. L. D. Emerson, Miss C. H. Hittell, C. C. Riedy.

March 24, 1892. J. M. Hutchings in the chair.

The following were elected to membership: Volney Rattan, Miss Kate Hodgkinson, Dr. C. B. Brigham, James Denman, Miss Bertha E. Stringer, Miss Lotta Bean, Miss K. E. Cole, Mrs. L. H. Sharp, Miss Jessie Smith, Mrs. M. F. McRoberts, Theodor Michaelis, Dr. Joseph Pescia, Prof. W. M. Searby.

Mrs. Katharine Bandegee read a paper on the Fertilization of Flowering Plants.

The speaker gave a brief outline of the reproductive processes, as far as understood, of Phanerogamic and Cryptogamic plants, and showed that the latter approached much nearer the animal kingdom by their motile spermatozoids and necessity of fluid media. The fertilization of flowering plants is brought about by means of the winds, by the visits of insects and by the mechanism of the flowers themselves. The first two agencies, especially the second, had, the speaker thought, been unduly credited at the expense of the third. Dioecious and monœcious flowers were necessarily dependent upon the first two agencies, but in the great mass of annual plants, nearly all having hermaphrodite flowers, and so many of

them being in possession of a more or less elaborate mechanism whereby the pollen was brought in contact with the stigma of the same flower, it was logical to suppose that this mechanism was of some service. Attention was called particularly to the Onagraceæ, in many of which the flowers, even those with large and showy corollas were fully fertilized, while the bud was still firmly closed. Numerous instances were given of adaptations for self-fertilization.

Hybrids produced by the crossing of two distinct species rarely persisted in nature, and had not been enough studied. Closely related plants were often much more difficult to cross than more distant ones, the explanation is of course a purely mechanical one, to be sought for in the tissues of the respective plants. In one of the plants here shown, *Œnothera ovata*, which is invariably fertilized in the closed bud, the calyx-tube is from three to six inches in length, and the length of pollen-tube necessary to reach the ovules is an obvious factor in their fertilization. The consistency of the tissues of the stigma has also to be considered.

The term "cross-fertilization" has been very loosely applied in botany. Many use it indiscrimately to signify the crossing of the flowers in the same plant equally with the crossing of plants divergent for many generations. The first use is a misnomer for each plant if not an individual in the sense in which we ordinarily use in speaking of animals, is but a compound entity springing from a single germ.

In the fertilization of flowers by insects, the speaker said that observers preoccupied with the idea that "self-fertilization is injurious or destructive" had overlooked the importance of thrips, aphis and minute larvæ, which often cover the stigma with the pollen of the same flower.

The speaker was assisted by Mr. C. C. Riedy in showing under the microscope peculiar forms of pollen and the emission and entrance of pollen-tubes.

April 26, 1892. Miss Eastwood in the chair.

The following were elected to membership: Miss Kate Howell, E. P. Lynch, Mrs. E. W. Caswell, Miss Ottilie Schücking, Joseph Nordman, Miss Belle Ryan, Miss Edith Fassett, Miss Florence Lane, Miss Emily G. Britton, Mrs. Rowena C. Gray, Luther Burbank, J. Preuss, Mrs. A. B. Rice, Miss Agnes Regan, Miss Nettie Wade, Miss K. T. Callahan, A. L. Mann, B. L. Robinson.

Miss Alice Eastwood read a paper on Loco Weeds.

C. C. Riedy, assisted by W. E. Loy and L. M. King, gave a demonstration of the lower cryptogams under the microscope, ten instruments being used.

CALIFORNIA ZOOLOGICAL CLUB. *January 16, 1892.* The meeting was opened with a brief address by Dr. D. S. Jordon, following which a proposed constitution was read by the secretary pro tem. and adopted by the club. The following officers were then elected for the ensuing term:

President—Dr. David S. Jordan.
Vice-President—Walter E. Bryant.
Secretary—Charles A. Keeler.
Treasurer—Frank H. Vaslit.
Curator—F. O. Johnson.
Councilors—J. J. Rivers, W. E. Ritter, Dr. O. P. Jenkins, Miss Louise Bunnell.

January 30, 1892. President Jordan in the chair.

John Comstock, Professor of Entomology of Cornell and Stanford Universities, entertained the Club with a most instructive lecture on the subject of methods of scientific work, as illustrated in particular by a study of the methods of classification of insects. The speaker called attention to the great influence which the doctrine of evolution had had upon the methods of viewing scientific questions. Before the time of Darwin science had busied herself solely with the classification of species, but at the present time the great aim of scientific research is to trace the history of the changes and modifications in form and structure of parts—to study the function of organs.

If our knowledge of all the groups of organisms was complete it would be a comparatively simple matter to establish relationships, but the record is at best a fragmentary one, so our most satisfactory method is to trace each organ or part through all the stages of its evolution, and try to understand its use, rather than to attempt to follow the transformations of the species as a whole. Prof. Comstock then proceeded to illustrate this method of work by his investigations in the classification of butterflies and moths. He drew attention to the fact that in these insects the wings are covered with fine scales arranged in regular rows like tiled roofing. What can

this minute powder tell us of the history of butterflies and moths? An examination of various species discloses the fact that there is considerable diversity both in the structure and distribution of the scales. Among some species the scales are in the form of slightly flattened hairs, irregularly scattered over the surface of the wings. Between this type and the most specialized form of scale every gradation can be traced; and it is found, moreover, that in species in which the structure of the wings, antennæ and other parts discloses a lowly organization the irregularly disposed hairy form of scale is present. Furthermore, it is found that the specialization of the scale varies upon different parts of the wing.

In order to understand the use of these scales it is necessary to know something of the structure of the wing. The wing of the dragon-fly is cut up by a net work of intersecting veins, but in butterflies and moths the veins are fewer in number and cross-veining is rare. In the dragon-fly the mesh work of veins strengthens the wing, while in the butterflies and moths the scales perform this function. The more flat and regularly disposed the scales are, the greater will be their strength. Accordingly any variation in the direction of a flattened scale will be preserved by natural selection. It is to be expected, moreover, that the greatest change will occur in the region of greatest strain. It is found that this is indeed the case, for the scales are more flattened on the front than on the hind wing, and at the tip more than at the base. As an additional strengthener, ridges have been developed along the scale. Incidentally, these ridges have also been productive of a great variety of iridescent colors, by the interference of light. As soon as these color effects began to manifest themselves, sexual selection would be introduced as a factor in the modification of scales.

Having followed out one line of development it is necessary to correlate this with the evolution of other parts. The classification of insects is based largely upon the structure of the wings. In lower forms the wings are broad and far apart, while higher forms are distinguished by having them closer together and more compact. In order to give still greater strength to the stroke of the wings a bristle or clump of bristles known as a frenulum, is developed near the base of the upper edge of the secondary wing. When consisting of a bundle of bristles each one is a hollow tube, but when formed of but one bristle it is composed of a number of tubes joined to-

gether. It thus becomes apparent that the latter is a higher structure than the former, being composed of a bundle of bristles united into a single spine. Very frequently the female will have the frenulum in the form of a bundle when the male has but a single bristle. The reason of this is obvious, for the male is called upon to make greater use of its wings in flying in search of the female, and thus requires a more perfect structure.

Sometimes the base of the hind wing is extended up in the form of a shoulder binding the two wings together, and thus replacing the frenulum. In the silkworm moth there is a lobe at the base of the wing and a mere rudiment of a frenulum; even in the male this frenulum consists of a bundle of hairs, such as is present in the female of most species. It is an interesting fact that degeneration seems to directly retrace its steps of progress, as indicated by the above example. One moth, *Hepialis*, which is in some respects rather lowly organized, was found to have neither frenulum nor lobe. In place of these a sort of loop or thumb was found upon the front wing which Prof. Comstock has termed the jugum. This jugum occurs also in *Micropteryx*, in which genus an elaborate arrangement exists to receive it.

The speaker concluded from the above facts that the *Lepidoptera* had developed along two distinct lines distinguished by the style of organ used in binding the wings together, and he accordingly proposes the division of the order into two suborders, the *Jugatæ* and the *Frenatæ*. From all this it may be learned that a true system of classification must be based upon a study of the uses of parts.

February 27, 1892. Dr. Jordan in the chair.

After the reading of the minutes Dr. H. W. Harkness was called to the chair, while the president addressed the club on The History of the Zoological Explorations of the Pacific Coast.

The lecturer was chiefly confined to a historical review of the work which has been done on the fishes of the coast. The substance of the talk was as follows:

The first person associated with the study of the fishes of the coast was the German naturalist Steller, who was sent by the Russian Government in 1731 to study the animals of Alaska. Notable among his discoveries was the great arctic sea-cow *(Rytina stelleri)*, a skeleton of which is now owned by the Academy of Sciences.

He published an account of the salmon of Alaska, describing five species in all, under Russian names. These five species still stand, and nothing new has since been added to our knowledge of the salmon of the coast. He also studied the trout and his conclusions have proved in general correct. Indeed, there has not since that time been a stronger man on this coast, and every ichthyologist must do honor to the ability of a man who was able to follow out all the complicated species of salmon and trout, before the time of Linnæus.

Walbaum, a compiler of natural history, affixed scientific names to these salmon and trout in a work published in 1792, and his name is accordingly cited as authority for the species which Steller discovered and described.

Another naturalist in the employment of the Russian Government, named Pallas, printed in 1811 an account of his explorations in the same country that Steller had visited, but his work was apparently not very highly appreciated at the time, for it was not distributed until twenty years later. Pallas' trip across Siberia was notable for the discovery of the mastodon in the ice. His work was carefully done, consisting largely in authenticating by repetition the work of Steller, although he also discovered many new species in Alaska.

The above period may be considered as constituting the prehistoric epoch in the history of Pacific Coast explorations. In the second stage may be mentioned the work of Gairdner and Kittlitz. About the year 1830 Dr. Gairdner, a physician living in Astoria, collected many fish, especially salmon and trout, which he sent to Sir John Richardson to be described in his classic Fauna Boreali Americana. At about the same time an unknown German named Kittlitz recorded a single new species of fish.

In 1849 the modern history of California began, and with the host of emigrants that flocked to the Pacific Coast came a number of men interested in natural history. In the year 1852 a number of papers appeared on science, the most extensive and spirited writing being done by Dr. W. O. Ayres. His papers, as was customary at the time, were first presented to the California Academy of Sciences, appearing on the following morning in the Daily Placer Times. These papers have since been reprinted in the regular Proceedings of the Academy. Dr. Ayres described a considerable number of new species of fish from the coast in a very creditable

manner, but the severe criticisms of Dr. T. A. Gill eventually drove him out of the work.

Dr. W. P. Gibbons, of Alameda, about the year 1854, became interested in the most unique feature of the ichthyology of the Pacific —viviparous fish. Some twenty species of viviparous surf fish are known from the Pacific Coast of America, and with the exception of two others found in Japan, form a unique group. Dr. Gibbons described all the species he knew, but at about the same time Prof. Louis Agassiz received specimens which he also described. Much difficulty and confusion has thus resulted in regard to the priority of names, although in the majority of instances it has been determined that Agassiz had priority of date. Agassiz also published the first descriptions of many species of fish from Washington and Oregon, although he never visited the coast himself.

Dr. Charles Girard, who was connected with the Smithsonian Institution, also described a number of the viviparous fish, which served to increase still further the difficulty of establishing priority of names.

Allusion was next made to the work of Dr. J. G. Cooper, who was present at the meeting. Dr. Cooper began work in 1856, on the fishes collected on the Geological Survey, mostly from the southern part of the State, and much of the early investigations in that region were due to him. He described, among other things, the most vicious of the sting-rays from the harbor of San Diego, naming it after a young boy who had the honor of being the first person known to be stung by it.

The Pacific Railrord survey was finished early in the fifties, and the fishes were described by Dr. Charles Girard, a pupil of Agassiz. Despite his unusually good facilities in the way of specimens and books, he did no really good work. He described a vast majority of the fishes of the coast, but in a very wooden way which proved a great set-back to the study of ichthyology. Girard indeed did all a man could do to make it difficult to determine the trout.

Andrew Garet was at the Academy at about this time, but he did no work on the fish of this coast excepting the description of one new species from Mexico. He contributed some valuable additions to our knowledge of the fishes of the Sandwich Islands, however.

George Suckley, a surgeon in the War Department, was stationed in Washington and Oregon, and supplemented the work of Girard

on the fishes of that district. He succeeded in carrying the confusion to an extreme, making as many as three genera from a single species of salmon, founded on differences of age and sex.

Dr. Theo. N. Gill, who has been connected with the Smithsonian Institution for the past thirty years, has published descriptions of many fish that have been sent him, although he has never made any collections on the coast personally. Being the most learned student of fish in America, he has occupied a unique position as a critic, and is undoubtedly the best scientific critic the world has produced.

In 1865 Alexander Agassiz wrote a work on the viviparous fish of the coast, settling most of the disputes in regard to priority of names. This closes the period of the discovery of California fish. The presence of the viviparous surf-fish and the viviparous rock-cods, and the other general outlines of the coast fish, were by this time generally known, although but little attention had been paid to the species inhabiting the deep seas.

In the present period Prof. Cope has described a number of new species, mostly from Alaska. Dr. Steindachner, a brilliant German scientist, found a number of new species. He investigated the salmon question to some extent but gave it up as a hopeless task and published nothing on the subject. Most of the fish which he described were from Southern California and Mexico, his work being for the most part very accurate and his figures unparalleled for the fineness of their execution. In 1879, a versatile Englishman, an editor, engineer, poet and naturalist, was at work in the Academy. He described a number of new species and made a critical study of the flounders of the coast.

"In 1880," said the speaker, "it was my good fortune to be sent by the United States Fish Commission to make a survey of the fishes of the coast, abundant facilities of every sort being provided." Seventy-five new species were discovered and the salmon question was settled, practically as it had been left by Steller. Prof. Gilbert, who was his clerk and assistant, has since become very prominent as an ichthyologist. He has spent two years at work on the Albatross, making many important contributions to our knowledge of the deep sea fishes of the Pacific.

Dr. T. H. Bean visited Alaska in 1880, and reached the same conclusions regarding the trout of Alaska that the speaker had drawn from his studies of the California fish. Mr. E. W. Nelson

also made a good many observations upon fish while stationed in Alaska. In San Diego Miss Rosa Smith worked on fish, and has the honor of being the first woman to describe any new species. Dr. Eigenmann carried on work at San Diego and San Francisco, and accomplished considerable on the study of the fish of these places.

For the last three years the United States Fish Commission Steamer Albatross has been at work on deep sea soundings and dredgings, Mr. C. H. Townsend being the naturalist of the vessel during all this time. The results of these dredgings have been of great importance, about three hundred new species having been discovered, many of them very startling and impossible forms. The whole fauna of the abyssal deeps is very strange and peculiar. The fish are soft-bodied and have either very large eyes to enable them to catch the faint glimmerings of light which may reach them, or else are entirely blind. Many species are provided with curious phosphorescent lanterns to enable them the better to find their way about. Practically nothing was known of these remarkable fish before the work of the Albatross brought them to light. Occasionally one would be found washed ashore after a storm, or in the stomach of some larger shore fish, but by far the large proportion of them were totally unheard of.

March 26, 1892. Mr. J. J. Rivers in the chair.

Mr. Wm. E. Ritter delivered an address giving an historical account of the development of Tornaria, and of Balanoglossus from Tornaria. The affinities of Tornaria to the larva of Echinodermata and of Balanoglossus to Amphioxus were pointed out. One of the chief purposes of the paper was to call the attention of the members of the club to the possibility of finding Tornaria upon this coast, and the speaker described the indications of its presence. It is found upon silty beaches between tides buried in sand or mud, and may always be recognized by the peculiar pyramidal coil of the cast which is thrown out.

Scientific and Medical Books and Minerals.

LARGEST STOCK IN THE WORLD.

SPECIAL CATALOGUES on any branch of Zoology and all Scientific and Medical subjects sent on application.

Collections of Minerals

FOR

Students and Others

AT

$1.00 Each

and upwards.

Choice Specimens of all Minerals for Colleges, Museums and Private Collectors.

☞ Our 128-page illustrated Catalogue of Minerals, 9th edition, now ready.

A. E. FOOTE, M. D., 4116 Elm Ave., Philadelphia.

CHARLES C. RIEDY,

— Dealer in —

MICROSCOPES, OBJECTIVES & ACCESSORIES.

All kinds of Microscopical and Biological Supplies on hand or furnished to order.

432 MONTGOMERY ST. SAN FRANCISCO, CAL.

FOR EXCHANGE.

Fragments of petrified bone of the Mastodon and Saurian, plainly showing tissue, in exchange for bird's eggs. The remains were recently discovered in one of the caverns of the Grand.

Address, PAUL E. KENNEDY,
Grand Junction, Colorado.
Member Western Colo. Academy of Science.